

# EP Series

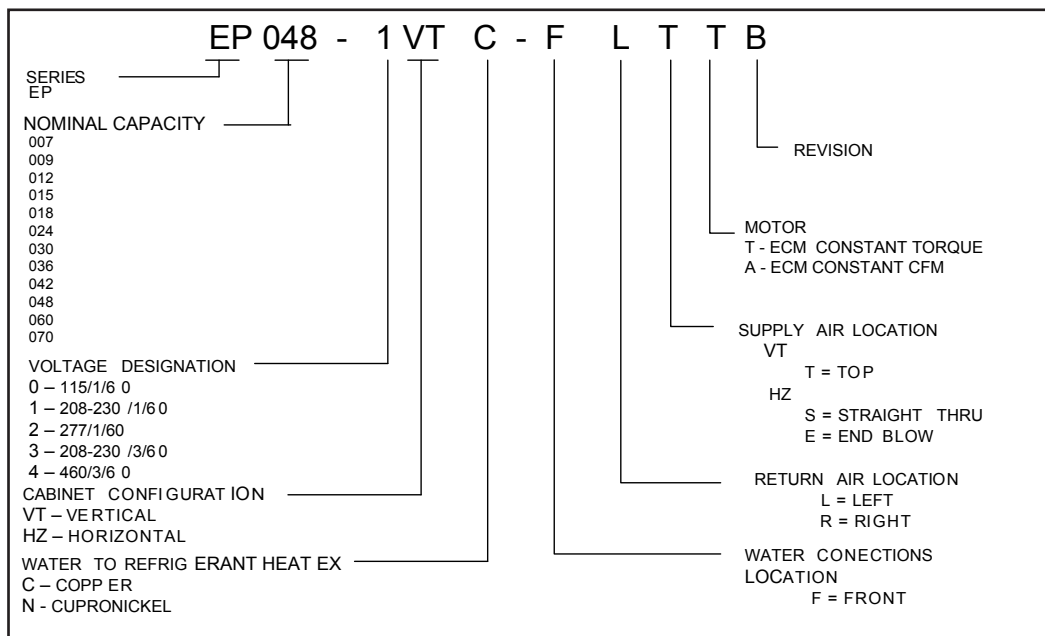
## Installation and Maintenance Manual



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**MODEL NOMENCLATURE**



## INITIAL INSPECTION

Be certain to inspect all cartons or crates on each unit as received at the job site before signing the freight bill. Verify that all items have been received and that there are no visible damages; note any shortages or damages on all copies of the freight bill. In the event of damage or shortage, remember that the purchaser is responsible for filing the necessary claims with the carrier. Concealed damages not discovered until after removing the units from the packaging must be reported to the carrier within 24 hours of receipt.

## GENERAL DESCRIPTION

These Packaged System Heat Pumps provide the best combination of performance and efficiency available. Safety devices are built into each unit to provide the maximum system protection possible when properly installed and maintained.

The EP Water-to-Air Heat Pumps conform to UL1995 standard and are certified to CAN/CSA C22.1 No 236 by Intertek-ETL. The Water-to-Air Heat Pumps are designed to operate with entering fluid temperature between 25°F to 80°F in the heating mode and between 50°F to 110°F in the cooling mode. Efficiencies and capacities will vary as entering fluid and return air temperatures vary.



*50°F Min. EWT for well water applications with sufficient water flow to prevent freezing. Antifreeze solution is required for all closed loop applications where the fluid temperature may drop below 50°F. Cooling Tower/Boiler and Earth Coupled (Geo Thermal) applications should have sufficient antifreeze solution to protect against extreme conditions and equipment failure. Frozen water coils are not covered under warranty.*



*This product should not be used for temporarily heating/cooling during construction. Doing so may affect the unit's warranty.*

## MOVING AND STORAGE

If the equipment is not needed for immediate installation upon its arrival at the job site, it should

be left in its shipping carton and stored in a clean, dry area. Units must only be stored or moved in the normal upright position as indicated by the “UP” arrows on each carton at all times. If unit stacking is required, stack units as follows: Vertical units less than 6 tons, no more than two high; horizontal units less than 6 tons, no more than three high. Do not stack units larger than 6 tons.

## SAFETY CONSIDERATIONS

Installation and servicing of this equipment can be hazardous due to system pressure and electrical components. Only trained and qualified personnel should install, repair, or service the equipment. Untrained personnel can perform basic functions of maintenance such as cleaning coils and replacing filters.



*Before performing service or maintenance operations on the system, turn off main power to the unit. Electrical shock could cause personal injury or death.*

When working on equipment, always observe precautions described in the literature, tags, and labels attached to the unit. Follow all safety codes. Wear safety glasses and work gloves. Use a quenching cloth for brazing, and place a fire extinguisher close to the work area.

The blower motor should only be operated when a duct is installed and secured to heat pump duct collar in order to avoid possible injury.

## LOCATION

Locate the unit in an indoor area that allows easy removal of the filter and access panels, and has enough room for service personnel to perform maintenance or repair. Provide sufficient room to make fluid, electrical, and duct connection(s). If the unit is located in a confined space such as a closet, provisions must be made for return air to freely enter the space. On horizontal units, allow adequate room below the unit for a condensate drain trap and do not locate the unit above supply piping. These units are not approved for outdoor installation; therefore, they must be installed inside the structure being conditioned.

**Do not locate units in areas that are subject to freezing.**

## INSTALLATION



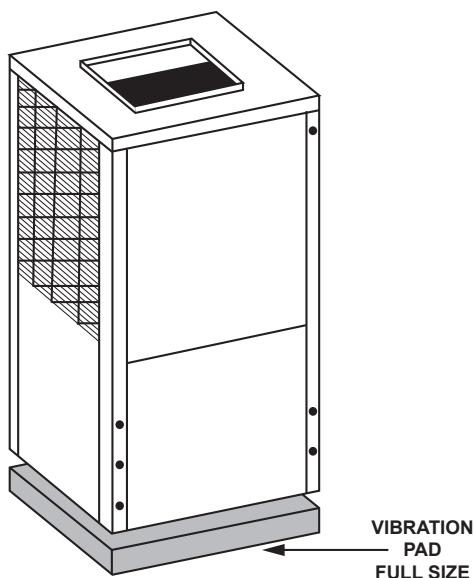
*Remove shipping block under blower housing.  
Loosen compressor mounting bolts.*

The installer should comply with all local codes and regulations which govern the installation of this type of equipment. Local codes and regulations take precedence over any recommendations contained in these instructions. In lieu of local codes, the equipment should be installed in accordance with the recommendations made by the National electric code, and in accordance with the recommendations made by the National Board of Fire Underwriters. All local seismic codes for seismic restraint of equipment, piping, and duct work shall be strictly adhered to.

### MOUNTING VERTICAL UNITS

Vertical units up to 6 tons are available in left- or right-hand return air configurations. Vertical units should be mounted level on a vibration absorbing pad slightly larger than the base to minimize vibration transmission to the building structure. It is not necessary to anchor the unit to the floor. (See Figure #1).

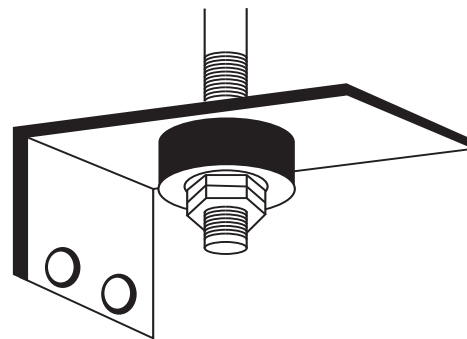
If the unit is located in a confined space such as a closet, provisions must be made for return air to freely enter the space.



**Figure #1 – Vertical unit on vibration pad**

### MOUNTING HORIZONTAL UNITS

While horizontal units may be installed on any level surface strong enough to hold their weight, they are typically suspended above a ceiling by threaded rods. The rods are usually attached to the unit corners by hanger bracket kits (P/N 930-008). (See Figure #2). The rods must be securely anchored to the ceiling. Refer to the hanging bracket assembly and installation instructions for details. Horizontal units installed above the ceiling must conform to all local codes. An auxiliary drain pan if required by code should be at least four inches larger than the bottom of the heat pump. Plumbing connected to the heat pump must not come in direct contact with joists, trusses, walls, etc.



**Figure #2 – Typical horizontal unit hanging bracket**

Some applications require an attic floor installation of the horizontal unit. In this case the unit should be set in a full size secondary drain pan on top of a vibration absorbing mesh. The secondary drain pan prevents possible condensate overflow or water leakage damage to the ceiling. The secondary drain pan is usually placed on a plywood base isolated from the ceiling joists by additional layers of vibration absorbing mesh. In both cases, a 3/4" drain connected to this secondary pan should be run to an eave and able to drain to a location that will be noticeable. If the unit is located in a crawl space, the bottom of the unit must be at least 4" above grade to prevent flooding of the electrical parts due to heavy rains.

Locate the heat pump unit in an area that provides sufficient room to make water and electrical

connections, allowing easy removal of the access panels, and replacement of air filters for routine maintenance. This will ensure proper work space for service personnel to perform maintenance or repair. See Unit Specifications for replacement filter sizes in the back of this manual to ensure proper clearances are provided during installation. Allow adequate room below the unit for a condensate drain trap on horizontal units.

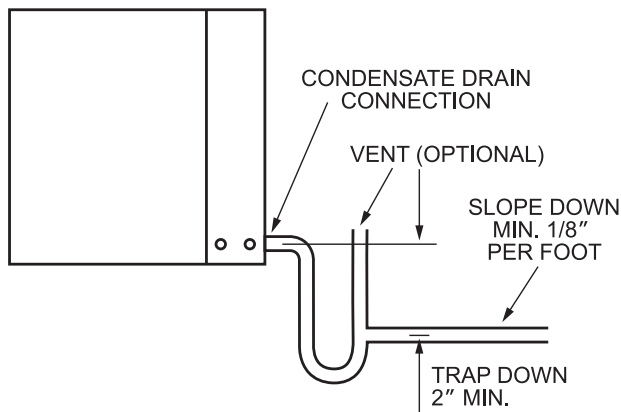


*Water freezes at 32°F. Frozen water coils are not covered under the limited product warranty. It is the installer's responsibility to insure that the heat pump unit is installed in a location or have taken the proper precautions in order to prevent rupturing the water coil due to freezing conditions.*

The heat pump unit is designed for conditioned space installation only. If the source water is subjected to conditions where ambient temperatures can fall below freezing, some form of freeze protection should be employed. In an open loop system this may entail running the water pump continuously to prevent freezing. An antifreeze solution wherever possible should be used if water will be subject to freezing. Consult the factory in these instances for guidance.

**CONDENSATE DRAIN**

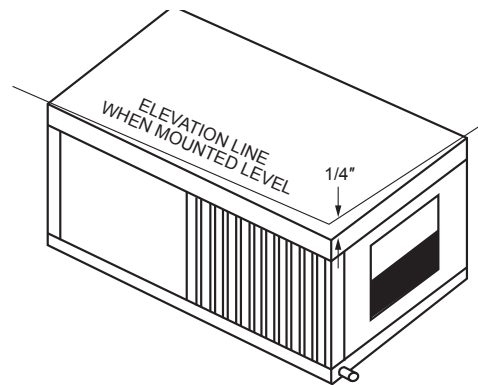
A drain line must be connected to the heat pump and pitched away from the unit a minimum of 1/8" per foot to allow the condensate to flow away from the unit.



**Figure #3— Heat pump condensate trapping**

This connection must be in conformance with local plumbing codes. A trap must be installed in the condensate line to insure free condensate flow. (Heat Pumps are not internally trapped). A vertical air vent is sometimes required to avoid air pockets (See Figure #3). The length of the trap depends on the amount of positive or negative pressure on the drain pan. A second trap must not be included.

The horizontal unit should be pitched approximately 1/4" towards the drain in both directions, to facilitate condensate removal. See Figure 4 below.



**Figure #4 – Sloped horizontal unit installation**

**DUCT SYSTEM**

A supply air outlet collar and return air duct flange are provided on all units to facilitate duct connections. See Unit Specifications for duct collar connection sizes in the back of this manual.

A flexible connector is recommended for supply and return air duct connections on metal duct systems. All metal ducting should be insulated with a minimum of one inch duct insulation to avoid heat loss or gain and prevent condensate forming during the cooling operation. Application of the unit to uninsulated duct work is not recommended as the unit's performance will be adversely affected. Do not connect ducts directly to the blower outlet; factory supplied duct collars should be used for the connection to minimize unit vibration and noise transmission to the ductwork and ultimately into the conditioned space. The factory provided air filter must be removed when using a filter back return air grill. The factory filter should be left in place on a free return system.

If the unit will be installed in a new installation which includes new duct work, the installation should be designed using current ASHRAE procedures for duct sizing. If the unit is to be connected to existing ductwork, a check should be made to assure that the duct system has the capacity to handle the air required for the unit application. If the duct system is too small, larger ductwork should be installed. Check for existing leaks and repair as necessary to ensure a tight air seal within duct. The duct system and all diffusers should be sized to handle the designed air flow quietly. To maximize sound attenuation of the unit blower, the supply and return air plenums should be insulated. There should be no direct straight air path thru the return air grille into the heat pump. The return air inlet to the heat pump must have at least one 90 degree turn away from the space return air grille. If air noise or excessive air flow are a problem, the blower speed can be changed to a lower speed to reduce air flow. (Refer to ECM motor speeds and settings in Table #1)



*Always disconnect power to the unit before changing motor speed to prevent damage to the motor, injury or death due to electrical shock.*

## ELECTRICAL



*Always disconnect power to the unit before servicing to prevent injury or death due to electrical shock or contact with moving parts.*

All field wiring must comply with local and national fire, safety and electrical codes. Power to the unit must be within the operating voltage range indicated on the unit's nameplate. On three phase units, phases must be balanced within 2%.



*Operating the unit with improper line voltage or with excessive phase imbalance is hazardous to the unit and constitutes abuse and is not covered under warranty.*

Properly sized fuses or HACR circuit breakers must be installed for branch circuit protection. See equipment rating plates for proper size.

The heat pump units are provided with a concentric knock-out in the front right corner post for attaching common trade sizes of conduit. Route power supply wiring through this opening. Flexible wiring and conduit should be used to isolate vibration and noise from the building structure. Be certain to connect the ground lead to the ground lug in the control box. Connect the power leads as indicated on the unit wiring diagrams.

**Table 1: EP Motor CFM Selection (Constant Torque ECM)**

Units	Motor HP	Tap1	Tap2	Tap3	Tap4	Tap5
EP015	1/3	LOW	MED	HIGH	-	-
EP018	1/3	LOW	MED	HIGH	-	-
EP024	1/3	LOW	MED	HIGH	-	-
EP030	1/2	LOW	MED	HIGH	-	-
EP036	3/4	LOW	MED	HIGH	-	-
EP042	3/4	LOW	MED	HIGH	-	-
EP048	3/4	LOW	MED	HIGH	-	-
EP060	1	LOW	MED	HIGH	-	-
EP070	1	LOW	MED	HIGH	-	-

### THERMOSTAT CONNECTIONS

Thermostat wiring is connected to a 7 position low voltage terminal block in the electrical box. The thermostat connections and their functions are as follows:

- Y** Compressor Operation
- G** Fan
- O** Reversing Valve (energized in cooling)
- C** Transformer 24 VAC Common – 3 Connections
- R** Transformer 24 VAC Hot

If the unit is being connected to a thermostat with a malfunction light, this connection is made at the unit alarm output.

- [5] UPM Board Settings
- [6] Water Coil Freeze Connection
- [7] Air Coil Freeze Connection
- [8] LED Status-Diagnostic Connection
- [9] 24VAC Power Input
- [10] Compressor Contact Output
- [11] High Pressure Switch Connection
- [12] Call for Compressor Y1
- [13] Low Pressure Switch Connection
- [14] 24VAC Power Common
- [15] Condensate Overflow Sensor
- [16] Dry Contact
- [17] UPM Ground Standoff

### SAFETY DEVICES AND THE UPM CONTROLLER

Each unit is factory provided with a Unit Protection Module (UPM) that controls the compressor operation and monitors the safety

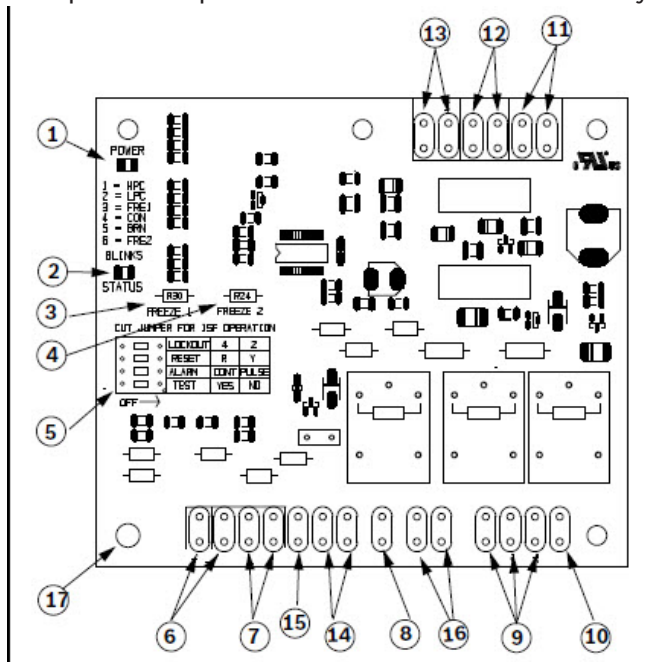


Figure #5

- [1] Board Power Indicator
- [2] UPM Status LED Indicator
- [3] Water Coil Freeze Protection Temperature Selection [R30]
- [4] Air Coil Freeze Protection Temperature Selection

**i** If the thermostat is provided with a malfunction light powered off of the common (C) side of the transformer, a jumper between “R” and “COM” terminal of “ALR” contacts must be made.

**i** If the thermostat is provided with a malfunction light powered off of the hot (R) side of the transformer, then the thermostat malfunction light connection should be connected directly to the (ALR) contact on the unit’s UPM board.

If the unit is being connected to a thermostat with a malfunction light, this connection is made at the unit malfunction output or relay. Refer to Figure #5.

Safety controls include the following:

High pressure switch located in the refrigerant discharge line and wired across the HPC terminals on the UPM

Low pressure switch located in the unit refrigerant suction line and wired across terminals LPC1 and LPC2 on the UPM.

UPM Board Dry Contacts are Normally Open (NO)

Water side freeze protection sensor, mounted close to condensing water coil, monitors refrigerant temperature between condensing water coil and thermal expansion valve. If temperature drops below or remains at freeze limit trip for 30 seconds, the controller will shut down the compressor and enter into a soft lockout condition. The default freeze limit trip is 30°F, however this can be changed to 15°F by cutting the R30 or Freeze1 resistor located on top of DIP switch SW1. Refer to Figure #5, item [3] for resistor location.

If unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the Freeze1 R30 resistor set to 30°F in order to shut down the unit at the appropriate leaving water temperature and protect your heat pump from freezing if a freeze sensor is included.

Evaporator freeze protection sensor, mounted between the thermal expansion device and the evaporator, monitors refrigerant temperature between the evaporator coil and thermal expansion valve. If temperature drops below or remains at freeze limit trip for 30 seconds, the controller will shut down the compressor and enter into a soft lockout condition. The default freeze limit trip is 30°F.

The condensate overflow protection sensor is located in the drain pan of the unit and connected to the 'COND' terminal on the UPM board.

#### UPM Board Factory Default Settings

Temp	30°F
Lockout	2
Reset	Y
Alarm	PULSE
Test	NO

#### UPM DIP SWITCH DEFAULT POSITION

lockout	4	2
reset	R	Y
alarm		Cont pulse
test	yes	no

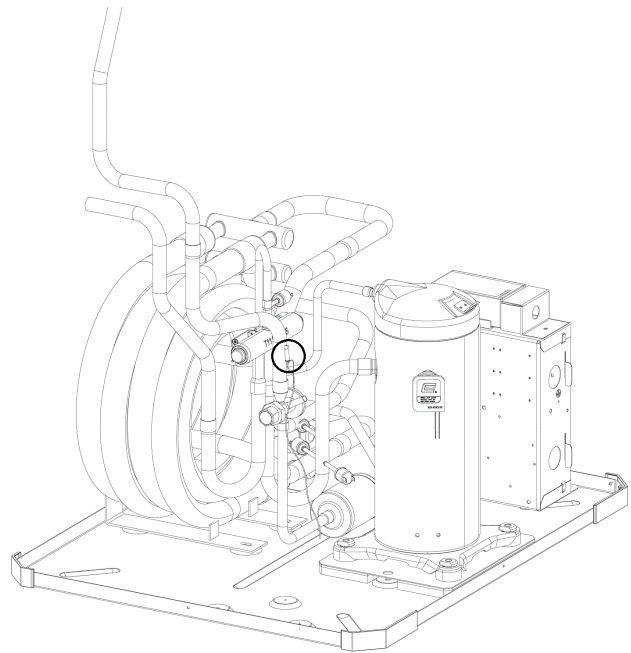


Figure #6



*If freeze protection sensor is not installed, a jumper between freeze contacts must be installed on the UPM board otherwise unit will not start.*



The UPM includes the following features:

- **ANTI-SHORT CYCLE TIME**—5 minute delay on break timer to prevent compressor short cycling.
- **RANDOM START**—Each controller has a unique random start delay ranging from 270 to 300 seconds to reduce the chances of multiple units simultaneously starting after initial power up or after a power interruption, creating a large electrical spike.
- **LOW PRESSURE BYPASS TIMER**—If the compressor is running and the low pressure switch opens, then the control will keep the compressor on for 120 seconds. After 2 minutes if the low pressure switch remains open, the control will shut down the compressor and enter a soft lockout. The compressor will not be energized until the low pressure switch closes and the anti-short cycle time delay expires. If the low pressure switch opens 2–4 times in 1 hour, the unit will enter a hard lock out and need to be reset.
- **BROWNOUT/SURGE/POWER INTERRUPTION PROTECTION**—The brownout protection in the UPM board will shut down the compressor if the incoming power falls below 18 VAC. The compressor will remain off till the voltage goes above 18 VAC and the anti short cycle timer (300 seconds) times out. The unit will not go into a hard lockout.
- **MALFUNCTION OUTPUT**—Alarm output is Normally Open (NO) dry contact. If 24 VAC output is needed R must be wired to the ALR-COM terminal; 24VAC will be available on the ALR-OUT terminal when the unit is in alarm condition. If pulse is selected the alarm output will be pulsed. The fault output will depend on the dip switch setting for “ALARM”. If it set to “CONST”, a constant signal will be produced to indicate a fault has occurred and the unit requires inspection to determine the type of fault. If it is set to “PULSE”, a pulse signal is produced and a fault code is detected by a remote device indicating the fault. See L.E.D. Fault Indication below for blink code explanations. The remote device must have a malfunction detection capability when the UPM board is set to “PULSE”.
- **TEST DIP SWITCH**—A test dip switch is provided to reduce all time delay settings to 10 seconds during troubleshooting or verification of unit operation. Note that operation of the unit while in test mode can lead to accelerated wear and premature failure of the unit. The “TEST” switch must be set back to “NO” for normal operation.
- **FREEZE SENSOR**—The default setting for the freeze limit trip is 30°F (sensor number 1); however this can be changed to 15°F by cutting the R30 resistor located on top of the DIP switch SW1. The default setting for the freeze limit trip is 30°F (sensor number 1); however this can be changed to 15°F by cutting the R24 resistor located on top of the DIP switch SW1. Since freeze sensor 2 is dedicated to monitor the evaporator coil it is recommended to leave the factory default setting on the board. The UPM controller will constantly monitor the refrigerant temperature with the sensor mounted close to the condensing water coil between the thermal expansion valve and water coil. If temperature drops below or remains at the freeze limit trip for 30 seconds, the controller will shut the compressor down and enter into a soft lockout condition. Both the status LED and the Alarm contact will be active. The LED will flash (three (3) times) the code associated with this alarm condition. If this alarm occurs 2 times (or 4 if Dip switch is set to 4) within an hour the UPM controller will enter into a hard lockout condition. It will constantly monitor the refrigerant temperature with the sensor mounted close to the evaporator between the thermal expansion valve and evaporator coil . If temperature drops below or remains at the freeze limit trip for 30 seconds, the controller will shut the compressor down and enter into a soft lockout condition. Both the status LED and the Alarm contact will be active. The LED will flash (six (6) times) the code associated with this alarm condition. If this alarm occurs 2 times (or 4 if Dip switch is set to 4) within an hour the controller will enter into a hard lockout condition.



*If unit is employing a fresh water system (no anti-freeze protection), it is extremely important to have the “Freeze” jumper R42 resistor set to 30°F in order to shut down the unit at the appropriate leaving water temperature and protect your heat pump from freezing if a freeze sensor is included.*

- **L.E.D. FAULT INDICATION**—Two L.E.D. indicators are provided:
  - Green: Power L.E.D. indicates 18–30 VAC present at the board.
  - Red: Fault indicator with blink codes as follows:
    - One blink—High pressure lockout
    - Two blinks—Low pressure lockout
    - Three blinks—Freeze sensor lockout
    - Four blinks—Condensate overflow
    - Five blinks—Brownout
- **INTELLIGENT RESET**—If a fault condition is initiated, the 5 minute delay on break time period is initiated and the unit will restart after these delays expire. During this period the fault LED will indicate the cause of the fault. If the fault condition still exists or occurs 2 or 4 times (depending on 2 or 4 setting for Lockout dip switch) before 60 minutes, the unit will go into a hard lockout and requires a manual lockout reset. A single condensate overflow fault will cause the unit to go into a hard lockout immediately, and will require a manual lockout reset.
- **LOCKOUT RESET**—A hard lockout can be reset by turning the unit thermostat off and then back on when the “RESET” dip switch is set to “Y” or by shutting off unit power at the circuit breaker when the “RESET” dip switch is set to “R”.



*The blower motor will remain active during a lockout condition.*

- **UPM BOARD DEFAULT SETTINGS**—Your UPM board will come from the factory with the following default settings:
  - **Freeze**—“Terminals not jumped” on all the time
  - **Temp**—30°F
  - **Lockout**—2
  - **Reset**—“Y”
  - **Alarm**—“PULSE”
  - **Test**—“NO”
  - **Dry Contact**—“Normally Open (NO)”

## Considerations

1. Always check incoming line voltage power supply and secondary control voltage for adequacy. Transformer primaries are dual tapped for 208 and 230 volts. Connect the appropriate tap to ensure a minimum of 18 volts secondary control voltage. 24 volts is ideal for best operation.
2. Long length thermostat and control wiring leads may create voltage drop. Increase wire gauge or up-size transformers may be required to insure minimum secondary voltage supply.
3. FHP recommends the following guidelines for wiring between a thermostat and the unit: 18 GA up to 60 foot, 16 GA up to 100 ft and 14 GA up to 140 ft.
4. Do not apply additional controlled devices to the control circuit power supply without consulting the factory. Doing so may void equipment warranties.
5. Check with all code authorities on requirements involving condensate disposal/over flow protection criteria.

## SEQUENCE OF OPERATION

### Cooling Mode

See Typical Wiring Diagram page 24. Energizing the “O” terminal energizes the unit reversing valve in the cooling mode. The fan motor starts when the “G” terminal is energized.

When the thermostat calls for cooling (Y), the loop pump or solenoid valve if present is energized and compressor will start.

Once the thermostat is satisfied, the compressor shuts down accordingly and the fan ramps down to either fan only mode or off over a span of 30 seconds (ECM Motors).

Note that a fault condition initiating a lockout will de-energize the compressor.

### Heating Mode

Heating operates in the same manner as cooling, but with the reversing valve de-energized. The

compressor will run until the desired setpoint temperature on the thermostat is achieved.

Once the thermostat is satisfied, the compressor shuts down and the fan ramps down in either fan only mode or turns off over a span of 30 seconds. Auxiliary electric heating coils are not available on the EP product line.

Once the thermostat reaches set point temperature and the humidity is above set point, the unit will operate in the hot gas reheat mode first by cooling and dehumidifying, then reheating the air using hot refrigerant gas before delivering it to the space usually 2°F to 5°F below room temperature. The unit is operating as a dehumidifier. By reheating the

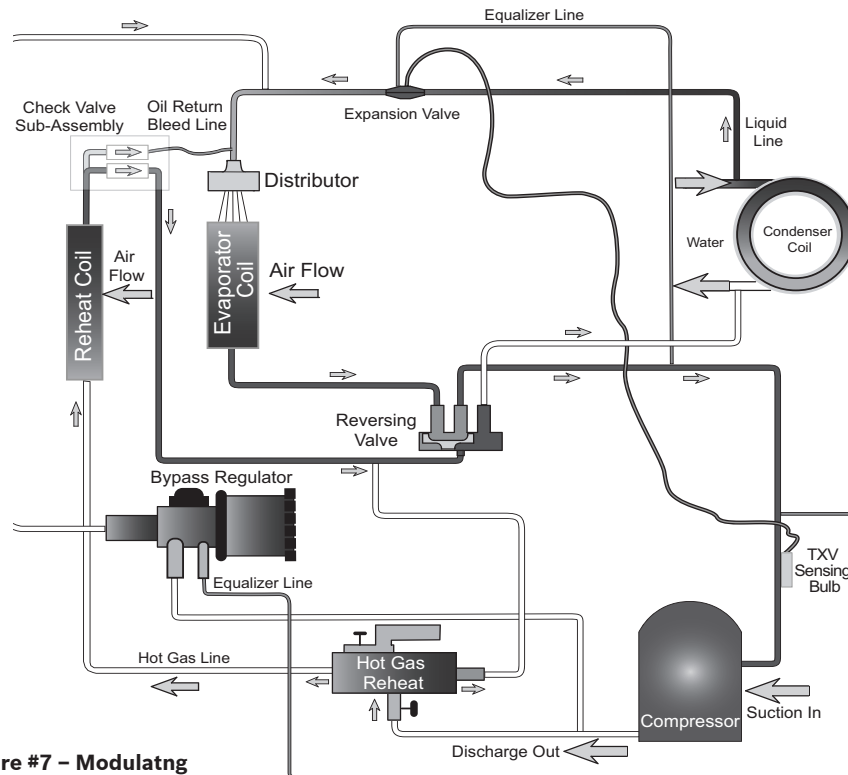


Figure #7 – Modulating hot gas reheat with

## UNIT OPTIONS HOT GAS REHEAT (HGR)

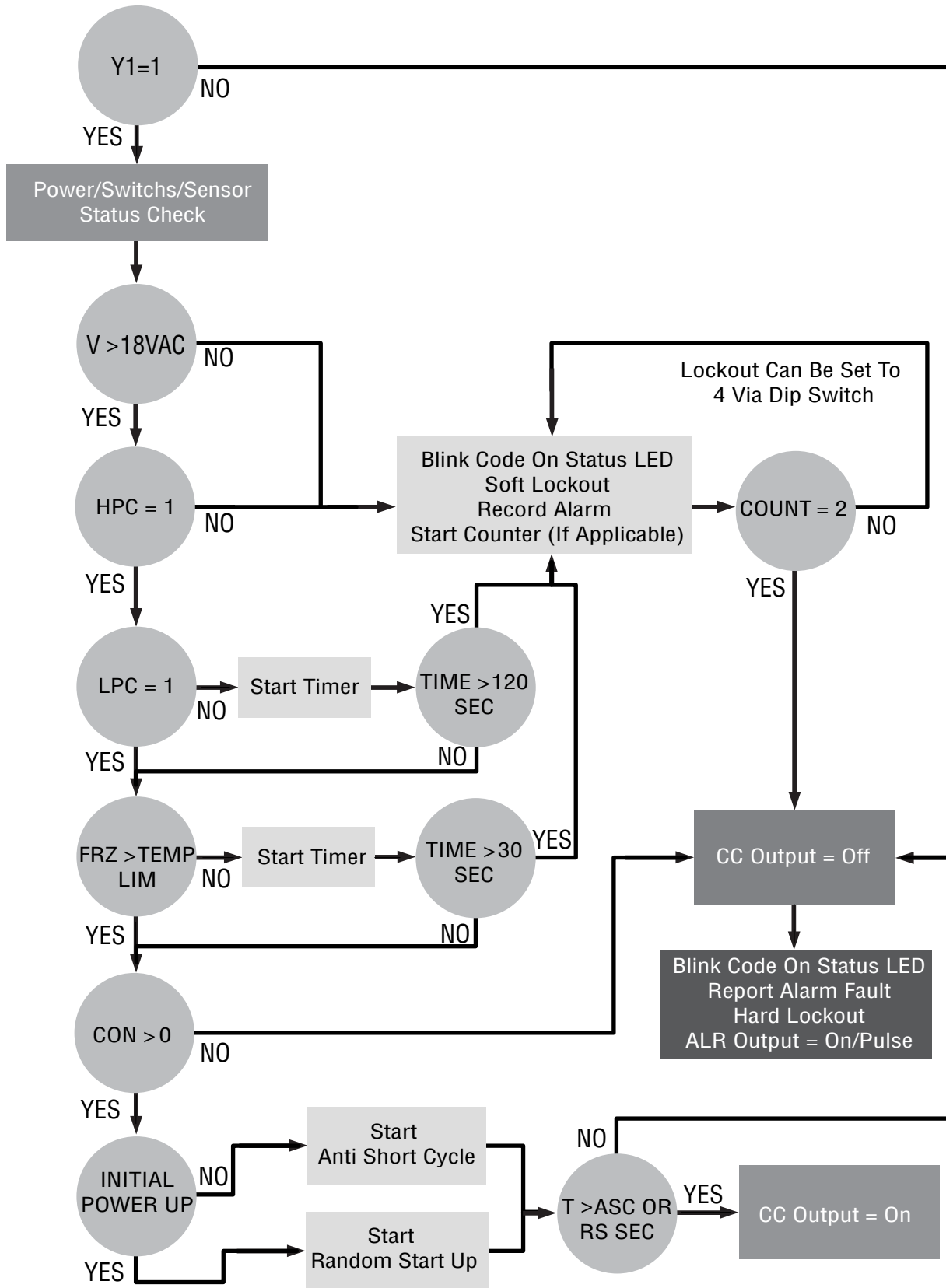
Hot gas reheat allows the user to not only control space temperature, but also humidity levels within the conditioned space. An excess of moisture in the space can allow mold growth leading to damage in the structure or interior surfaces as well as reducing the air quality and creating an unhealthy environment.

The typical control of a unit is by a thermostat that senses the temperature in the space. By utilizing a humidistat in addition to the thermostat we are able to monitor the humidity levels in the space as well. The HGR option allows cooling and dehumidification to satisfy both the thermostat and humidistat.

air along a constant sensible heat line the relative humidity of the supply air is reduced.

The moisture removal capacity of a specific heat pump is determined by the unit latent capacity rating. A heat pump's latent capacity can be determined by reviewing the heat pump specification data sheets. Depending upon the entering water and air conditions a total and sensible capacity can be interpolated from the data sheets. Subtracting sensible capacity from total capacity yields latent capacity. Dividing the latent capacity by 1069 (BTU/LB of water vapor at 80° DB and 67° WB) yields the amount of moisture removal in pounds per hour.

UPM Sequence of Operation (SOO) Flow Chart



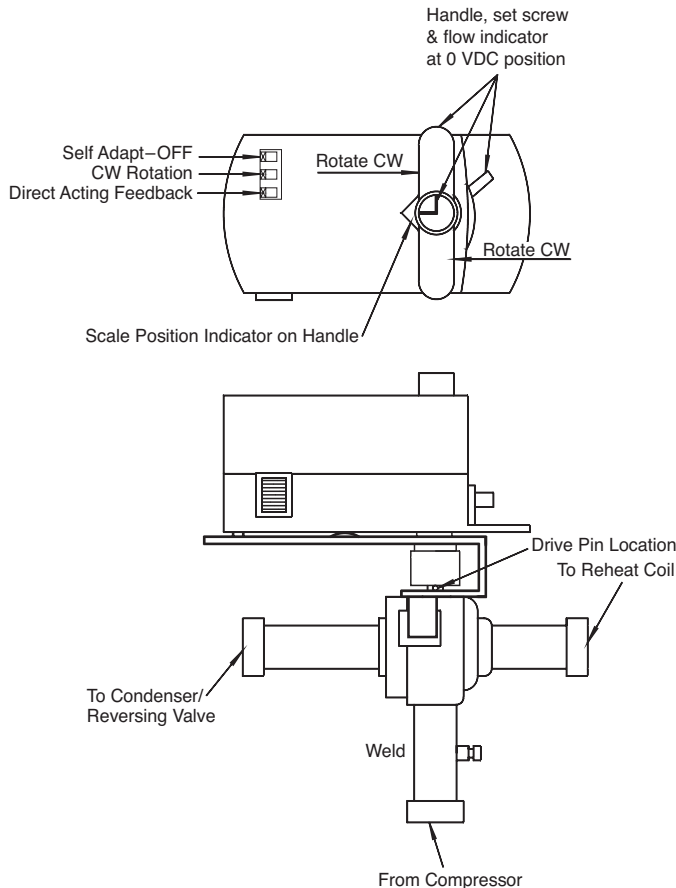


Figure #8 – Modulating Hot Gas Reheat Valve

## Refrigerant Flow Path

A hot gas reheat valve and a reheat coil are included in the refrigerant circuit. The refrigerant circuit in the cooling and heating mode is identical to a standard heat pump.

In the reheat mode the compressor discharge gas is diverted through the reheat valve to the reheat coil which is located downstream of the cooling coil. The superheated refrigerant gas reheats the air leaving the cooling coil. The hot refrigerant gas then passes through the water to refrigerant coil where it is condensed to a liquid. From this point the rest of the cooling cycle is completed as in a regular heat pump. There are two check valves to prevent refrigerant flow into the reheat coil during standard cooling/heating cycles. A small copper bleeder line is connected to the outlet line of the reheat coil and between the expansion valve outlet and distributor to the air coil. This line is necessary to let any liquid/oil that may have migrated to the reheat coil during reheat to escape during standard cooling/heating modes. (See Figure 5)

## Sequence of Operation - On/Off Control

The sequence of operation in the cooling and heating mode is the same as a regular heat pump.

In the reheat mode on a call from the humidistat the reheat relay coil is energized through the “H” circuit. The blower relay, reversing valve and compressor contactor are energized through the contacts of the reheat relay. See typical wiring diagrams at the end of the manual. The cooling relay remains de-energized enabling the reheat solenoid (Note: The reheat mode always operates in the cooling mode.) Should the temperature in the space increase above set point the compressor terminal Y is energized which will de-energize the reheat valve putting the unit into the straight cooling mode. A call for cooling or heating will always take precedence over hot gas reheat.

## Hot Gas Reheat Controllers

There are several ways to control heat pumps with hot gas reheat. You should choose the means that best suits your specific application. See typical wiring diagrams and the end of the manual for some possible control sequences. Most heat pump compatible thermostats in conjunction with a humidistat are acceptable for use, (Note: “O” output for reversing valve energized in cooling mode is required.) Combination thermostats/ humidistat are also available.

## Special Considerations

Some applications require special consideration to maximize the performance of the hot gas reheat function:

- Low Temperature Well Water
- Indoor Pool Dehumidifying During Winter Months

Consult the factory for special application considerations.

## Low Temperature Well Water

When low temperature well water is utilized as the water source (below 55°F), a means of establishing two flow rates, one for the cooling/reheat mode and one for heating mode is recommended. In the cooling mode at low entering water temperatures and standard flow rates discharge pressures and corresponding discharge gas temperatures are relatively low. At these conditions when the reheat mode is initiated the low temperature discharge gas can reduce reheat capacity. A means to reduce the water flow rate and elevate the discharge pressure/ temperature in cooling/reheat mode should be provided. Conversely, at low entering water temperatures in the heating mode system suction pressure is reduced causing a loss in heating capacity. A means of providing higher flow in the heating mode should be provided. The simplest way to accomplish the above is to install water regulating valves.

## Indoor Pool Dehumidifying During Winter Months

It is important to remember that when in the reheat mode the heat pump is cooling and reheating. A secondary means of heating the space during the dehumidification mode should be provided. The indoor space temperature should be kept at least 2°F above the pool water temperature. If this is not done the warm pool water attempts to heat the space and the humidity levels increase exponentially. The heat pump is normally sized to handle the design latent load moisture removal. A second heat pump or resistance heat should be provided to handle the structural loss load.



*A protective coating is highly recommended for all pool applications due to the highly corrosive chemical environment.*

## Operating Pressures and Temperatures

Operating pressures and temperatures in the reheat mode vary slightly from standard cooling mode operating characteristics. The variations are as follows:

Discharge Pressure: (-) 5 to 20 PSIG

Discharge Gas Temperature: (-) 5°F to 15°F

Suction Pressure: (+) 5 to 10 PSIG

Suction Gas Temperature: (+) 5°F to 10°F

## Sequence of Operation - Modulating Hot Gas Reheat (MHGRH)

Modulating Hot Gas Reheat differs from On/Off in that the reheat function is always active. The purpose of MHGRH is to deliver air at or close to neutral conditions.

FHP modulating hot-gas reheat uses a modulating hot gas valve that is controlled by a duct thermostat and temperature sensor. This modulates the hot gas flow to the reheat coil raising the temperature of the air and maintaining the preset temperature of the supply air.

The thermostat sends a DC signal of 0 – 10 volts to the motorized valve which, depending on the supply air temperature, will open or close to maintain the preset temperature setting.

System Set Up:

1. Determine piping arrangement of re-heat valve. Refer to Figure 7, hot gas enters the center port and may leave through the right or left ports depending on stage of operation.
2. With power off, install the duct sensor.
3. Install the thermostat at a location that can be easily accessed.
4. Wire the thermostat, sensor and unit as shown in the wiring diagram supplied.
5. See the Typical Wiring Diagram for volts dial and dip switch settings for thermostat.
6. With all connections made, turn power on and observe Hot Gas Valve actuator movement.
7. Set the thermostat to its highest or lowest value and observe Hot Gas Valve actuator movement.

On FHP units' gas flow to Hot Gas Coils is made with the increase of DC volts output from Duct Stat.

8. Check actuator location pin for movement during modulation. If there is no movement of pin and the actuator is moving, locate set-screw and tighten motor body on actuator shaft.
  - a) To tighten, unscrew set-screw so that it is loose (use a 3mm metric Allan wrench), ensure that shaft is all the way to the CCW position (use a wrench if necessary)
  - b) Locate clutch release knob (top left of Motor body) Press knob down, while holding down, rotate turn knob to full CCW position. Tighten set-screw.
 

**Note:** When the pin is to the right, hot gas flows to the right (Hot Gas Coil) and if to the left, hot gas flows to the left (Condenser Coil).
  - c) An outdoor air low limit switch can be placed between Transformer and R of the terminal block to keep the Compressors from running below 65 degrees entering outdoor temperature.
  - d) The factory provided-field installed discharge air temperature sensor installed by the contractor in the units discharge air plenum controls the position of the modulating hot gas reheat valves to maintain a desired constant discharge air temperature. This sensor should be installed at least 10 feet from the units discharge air outlet to ensure proper mixing of the leaving air.
  - e) In situations of low fluid temperature the amount of hot gas could be limited and the design leaving air temperature may not be attained. This can be remedied by the use of field supplied head pressure controlled water regulating valves or manually adjusting the water flow rates accordingly.

Depending on the application in the unoccupied mode the unit should be disabled through some type of relay or time clock and the outside air damper be closed. This will ensure that raw or unconditioned outside air is not introduced into the building during the unoccupied mode.



Control of the hot gas modulation is by the thermostat in the supply air duct or through the building management system. A separate controller is used to control the unit itself.

### ELECTRIC HEAT

Internally mounted supplemental electric heat is available on select models of the EP series. Electric heating elements can operate along with reverse cycle heating as auxiliary heat or in lieu of reverse cycle heating (refrigeration heating) as emergency backup heat.

Availability matrix, including available nominal kW capacities is shown below:



Internal mounted Electric Heat is only available on top blow vertical cabinets, end blow horizontal cabinet.



Internal Electric Heat cannot be provided with hot gas reheat. Units with internal Electric Heat must have 2 field power supplies.

Units	5kW	10 kW	15 kW	20 kW
EP018	✓	x	x	x
EP024	✓	✓	x	x
EP030	✓	✓	x	x
EP036	✓	✓	✓	x
EP042	✓	✓	✓	x
EP048	✓	✓	✓	✓
EP060	✓	✓	✓	✓
EP070	✓	✓	✓	✓

### HEAT RECOVERY PACKAGE

The Heat Recovery package is a factory mounted option. It consists of a forced pumped unit that employs a circulating pump to move water through a double wall/vented heat exchanger and returns the heated water to the water tank. The water is heated by superheated refrigerant discharge gas from the compressor. This waste heat of the cooling mode captured by the heat recovery increases the capacity and efficiency of the heat pump unit. If the air temperature is uncomfortable coming from the air vents in the heating mode the heat recovery may need to be turned off. In the heating mode the heat recovery captures heat that would normally be used for space heating.



*If heat recovery unit is installed in an area where freezing may occur, the unit must be drained during winter months to prevent heat exchanger damage. Heat exchanger ruptures that occur due to freezing will void both the heat recovery package warranty and the heat pump warranty.*

### HOT GAS BYPASS

The function of the hot gas bypass valve is to prevent icing of the air coil when the unit is operating at low load conditions. This situation could arise if the space experiences widely varying loads, for example a conference center. Without a hot gas bypass circuit the evaporating temperature will fall and ice could form on the coil restricting air flow and aggravating the situation. Eventually the coil could be totally blocked resulting in possible refrigerant liquid entering the compressor and failure of the system

The hot gas bypass valve is located in the discharge line from the compressor and diverts hot gas to the inlet of the air coil. The valve is factory set to open when the evaporating pressure falls to 75 PSI for an R-410A system and will modulate to prevent the pressure falling any lower. This setting is field adjustable and this set point may be adjusted as required.

### ECM INTERFACE BOARD- CONSTANT AIRFLOW MOTOR (OPTION)

In addition to providing a connecting point for thermostat wiring, the interface board also translates thermostat inputs into control commands for the Electronic Commutated Motor (ECM) DC fan motor and provides thermostat signals to unit's UPM board. The thermostat connections and their functions are as follows:

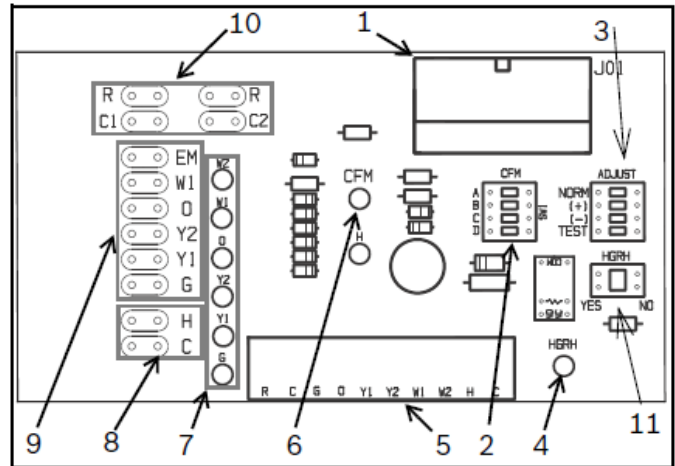


Figure #9

- [1] Motor harness plug
- [2] Blower CFM adjustment
- [3] Motor settings
- [4] Dehumidification indication
- [5] Thermostat digital contact inputs
- [6] CFM count indicator
- [7] Thermostat input status indication
- [8] Reheat digital outputs
- [9] Thermostat outputs
- [10] 24 VAC
- [11] Dehumidification method selector



*CFM LED is an approximation. Utilize conventional Test and Balance equipment for accurate airflow measurement.*



- CFM count indicator (See Figure #9, item [6]) blinks to indicate approximate airflow in CFM and may flicker when unit is off.
- Each blink of the LED represent approximately 100 CFM of air delivery so if the LED blinks 12 times, pauses, blinks 12 times, etc. the blower is delivering approximately 1200 CFM.

#### Thermostat Outputs

- Y1 First Stage Compressor Operation
- Y2 Second Stage Compressor Operation
- G Fan
- O Reversing Valve (energized in cooling)
- W1 Auxiliary Electric Heat (runs in conjunction with compressor)
- EM/W2 Emergency Heat (electric heat only)
- NC Transformer 24 VAC Common (extra connection)
- C1 Transformer 24 VAC Common (primary connection)
- R Transformer 24 VAC Hot
- H Dehumidification Mode

## AIRFLOW SELECTOR

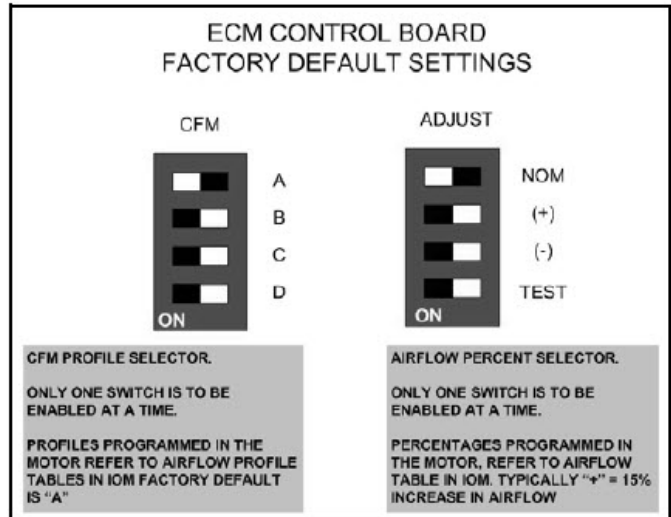
The airflow selector (Figure #9, items [2] & [3]) allows airflow adjustment to meet application requirements and to ease troubleshooting.



Only one switch can be enabled at a time. Refer to table for airflow settings.

CFM Selector (Fig #9, Item [2]) must remain with only "A" being enabled.

ADJUST Selector can be adjusted to NOM, (+), (-), or TEST. NOM, (+) and (-) can be adjusted as needed by application. TEST is used for troubleshooting to override unit airflow to 100%.



Do not set the ADJ DIP switch to the (-) setting when electric heaters are installed. Doing so may cause the heaters to cycle on their thermal overload switches, potentially shortening the life of the switches.



Always disconnect the power before changing DIP switch positions on the interface board, and then reset the unit.

## DEHUMIDIFICATION METHOD SELECTOR

Dehumidification method selector (Figure #13, item [11]) is used to select between the following two methods:

- 1) Units equipped with optional Hot Gas Reheat, on dehumidification call (the "H" terminal on the thermostat is energized) the reheat outputs will energize the hot gas reheat valve in the circuit and the heat pump will start in dehumidification mode.

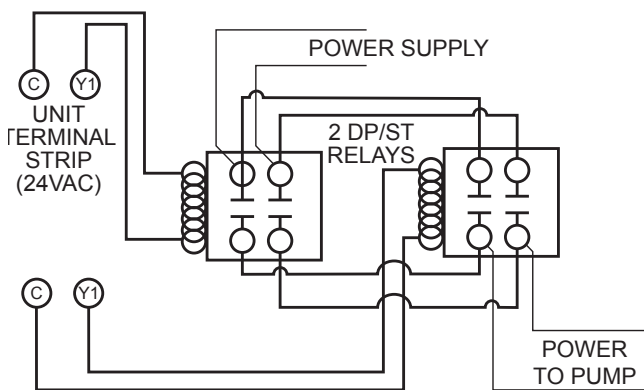
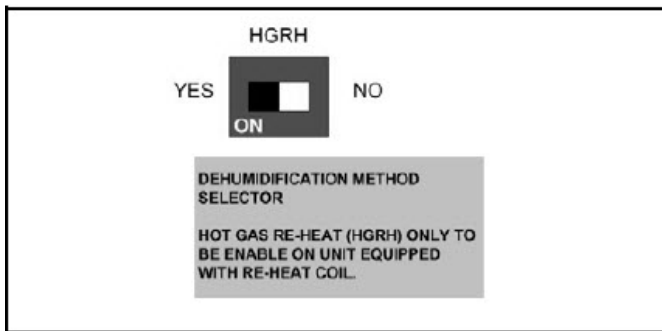
Dehumidification selector (Figure #9, item [11]) should be selected to 'YES'.

2) Units without optional Hot Gas Reheat, on dehumidification call, the heat pump fan will operate at a lower speed to increase dehumidification while cooling. Dehumidification selector ((Figure #9, item [11]) should be selected to 'NO'.

**i** In this mode, the heat pump will only dehumidify the space when it is running in cooling mode.

Dehumidification indicator LED (Figure #9, item [4]) will energize when dehumidification call is present.

To the left of the red and green status LED's is a row of 1/4" male quick connects. These are used to pass thermostat inputs on to the rest of the control circuit. Remember to always turn off unit power at the circuit breaker before attaching or disconnecting any wiring from these connections to avoid accidental short circuits that can damage unit control components.



## FLUID DIFFERENTIAL PRESSURE SWITCH (DPS)

Pressure/temperature ports are recommended in both the supply and return lines for system flow balancing. The water flow can be accurately set by measuring the water-to-refrigerant heat exchangers water side pressure drop. See the unit specification sheets for the water flow and pressure drop information in the back of this manual.

The discharge water from the heat pump is not contaminated in any manner and can be disposed of in various ways depending on local codes (i.e. discharge well, dry well, storm sewer, drain field, stream, pond, etc.

When using a single water well to supply both domestic water and the heat pump care must be taken to insure that the well can provide sufficient flow for both. In well water applications a slow closing solenoid valve must be used to prevent water hammer.

Solenoid valves should be connected across Y and C on the interface board for all. Make sure that the VA draw of the valve does not exceed the contact rating of the thermostat. The function of the differential switch is to prevent or stop compressor operation should the water supply fail. This will prevent the unit from locking out on a safety, requiring a manual reset to restart.

The switch is piped between the water entering and leaving connections. Should the pressure drop fall below set value the switch will open de-energizing the DPS relay thereby stopping the compressor.

The controller has an adjustment to change the minimum pressure differential required to open the switch and may require field adjustment.

The blower operation will not be affected by this option.

**i** The start-up process should include checking the operation of the switch when installed. This should be done after the system is balanced. Adjustment should be made if necessary.

**WATER PIPING**



*Water piping exposed to extreme low ambient temperatures are subject to freezing. Remember water freezes at 32°F.*

Supply and return piping must be as large as the water connections on the heat pump (larger on long runs). Never use flexible hoses of a smaller inside diameter than that of the water connections on the unit. The heat pump units are supplied with either a copper or optional cupro-nickel condenser.



*Galvanized pipe or fittings are not recommended for use with these units due to the possible galvanic corrosion.*

Both the supply and discharge water lines will sweat if subject to low water temperature. These lines should be insulated to prevent damage from condensation.

All manual flow valves used in the system must be ball valves. Globe and gate valves must not be used due to high pressure drop and poor throttling characteristics.

Never exceed the recommended water flow rates. Serious damage or erosion of the water to refrigerant heat exchanger could occur.



*Improper heat exchanger water flow due to piping, valve arrangement or improper pump operation is hazardous to the unit and constitutes abuse which will void the heat exchanger and compressor warranty.*

All heat pump units are equipped with female pipe thread fittings. Consult the specification sheets for sizes. Teflon tape sealer should be used when connecting water piping connections to the units to ensure against leaks and possible heat exchanger fouling. Do not over tighten the connections. Flexible hoses should be used between the unit and the rigid system to avoid possible vibration. Ball valves should be installed in the supply and return lines for unit isolation and unit water flow balancing.

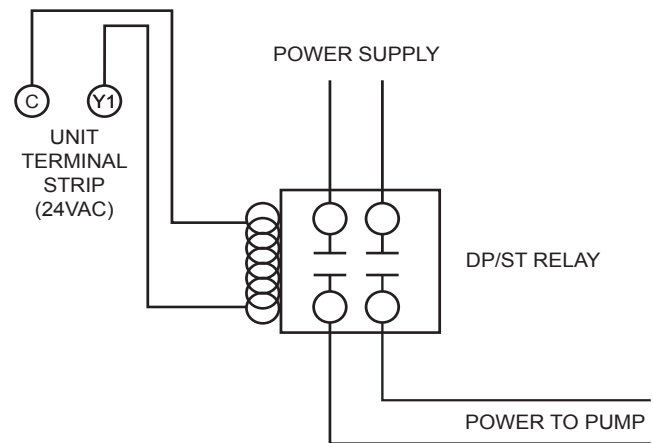
No unit should be connected to the supply or return piping until the water system has been completely cleaned and flushed to remove any dirt, piping chips or other foreign material. Supply and return hoses should be connected together during this process to

ensure the entire system is properly flushed. After the cleaning and flushing has taken place the unit may be connected to the water loop and should have all valves wide open.

**WELL WATER SYSTEMS**

Copper is adequate for ground water that is not high in mineral content. Should your well driller express concern regarding the quality of the well water available or should any known hazards exist in your area, we recommend proper testing to assure the well water quality is suitable for use with water source equipment. In conditions anticipating moderate scale formation or in brackish water, a cupro-nickel heat exchanger is recommended. In well water applications water pressure must always be maintained in the heat exchanger. This can be accomplished with either control valve or a bladder type expansion tank.

When well water is used exclusively for supplying water to the heat pump, the pump should operate only when the heat pump operates. A 24 volt double pole-single throw (DP/ST) contactor can be used to operate the well pump with the heat pump.



When two or more units are supplied from one well, the pump can be wired to operate independently from either unit. An upsized VA transformer may be required in either case.

**FRESH WATER SYSTEMS**

The Units shall be designed to operate throughout the range of entering fluid temperature of 50°F to 110°F in the cooling mode and 50°F to 80°F in the heating mode. Units shall have an operating range of 25 °F to 80°F in the heating mode when equipped with the optional extended range. In the cooling mode, heat is rejected from the FHP unit into the

water loop. A cooling tower provides evaporative cooling to the loop water thus maintaining a constant supply temperature to the unit. When utilizing open cooling towers, chemical water treatment is mandatory to ensure the water is free from corrosive elements.

A secondary heat exchanger (plate frame) between the unit and the open cooling tower may also be used. It is imperative that all air be eliminated from the closed loop side of the heat exchanger to insure against fouling.

In the heating mode, heat is absorbed from the water loop. A boiler can be utilized to maintain the loop at the desired temperature.



*Water piping exposed to extreme low ambient temperatures is subject to freezing.*

Pressure/temperature ports are recommended in both supply and return lines for system flow balancing. Water flow can be accurately set by measuring the water-to-refrigerant heat exchangers water side pressure drop. See specification sheets for water flow vs. pressure drop information in the back of this manual.

## EARTH COUPLED SYSTEMS

Closed loop and pond applications require specialized design knowledge. No attempt at these installations should be made unless the dealer has received specialized training. Utilizing FHP's Ground Loop Pumping Package (GLP), makes the installation easy. Anti-freeze solutions are utilized when low operating conditions are expected to occur. Refer to the GLP installation manuals for more specific instructions. A wrapped water coil option is required for this application.

### System Checkout

After completing the installation, and before energizing the unit, the following system checks should be made prior to initial startup:

- Verify that the supply voltage to the heat pump is in accordance with the nameplate ratings
- Make sure that all electrical connections are tight and secure
- Check the electrical fusing and wiring for the correct size

- Verify that the low voltage wiring between the thermostat and the unit is correct
- Verify that the water piping is complete and correct
- Check that the water flow is correct, and adjust if necessary
- Check the blower for free rotation, and that it is secured to the shaft
- Verify that vibration isolation has been provided
- Unit is serviceable. Be certain that all access panels are secured in place
- Verify that the blower support has been removed
- Verify that duct work has been properly fastened to supply and return duct collars
- Make sure return air filters are positioned correctly in the filter rack if removed during installation

## UNIT START-UP

1. Set the thermostat to the highest setting.
2. Set the thermostat system switch to "COOL", and the fan switch to the "AUTO" position. The reversing valve solenoid should energize. The compressor and fan should not run.
3. Reduce the thermostat setting to approximately 5 degrees below the room temperature.
4. Verify the heat pump is operating in the cool mode.
5. Turn the thermostat system switch to the "OFF" position. The unit should stop running and the reversing valve should de-energized
6. Leave the unit off for approximately (5) minutes to allow for system equalization.
7. Turn the thermostat to the lowest setting. The compressor and fan should not run.
8. Set the thermostat switch to "HEAT".
9. Increase the thermostat setting approximately 5 degrees above the room temperature.
10. Verify the heat pump is operating in the heating mode.
11. Set the thermostat to maintain the desired space temperature.
12. Check for vibrations, leaks, etc...

## IN-WARRANTY MATERIAL RETURN

When contacting your Representative for service or replacement parts, refer to the model and serial number of the unit as stamped on the data plate attached to the unit.

Material may be returned to the factory only with permission of an authorized factory representative. A "Warranty Return Material" tag must be attached to the returned material. Assure that all of the information as called for on the tag is filled out completely and accurately to expedite handling and insure prompt issuance of credits.

Freight charges for all items returned to the factory shall be prepaid. The return of the part does not constitute an order for a replacement. Therefore, a purchase order must be entered through your nearest representative. The order shall include the part number, model number, and serial number of the unit involved. If the part is within the warranty period, and after our inspection of the returned part proves that the failure is due to faulty material or workmanship a credit or replacement part will be issued.



*Parts returned without a completed "Warranty Return Material" tag will not be credited.*

## MAINTENANCE

1. Filter changes or cleanings are required at regular intervals. The time period between filter changes will depend upon type of environment the equipment is used in. In a single family home, that is not under construction, changing or cleaning the filter every 60 days may be sufficient. In other applications such as motels, where daily vacuuming produces a large amount of lint, filter changes may be need to be as frequent as biweekly. See unit specifications for replacement filter sizes. Note that horizontal units containing two filters are taped together at the factory to facilitate removal. This should be done by end user as new filters are installed.



*Operating the unit with improper line voltage or with excessive phase imbalance is hazardous to the unit and constitutes abuse and is not covered under warranty.*

2. An annual "checkup" is recommended by a licensed refrigeration mechanic. Recording the performance measurements of volts, amps, and water temperature differences (both heating and cooling) is recommended. This data should be compared to the information on the unit's data plate and the data taken at the original startup of the equipment.
3. The condensate drain should be checked annually by cleaning and flushing to insure proper drainage.
4. Periodic lockouts almost always are caused by air or water flow problems. The lockout (shutdown) of the unit is a normal protective measure in the design of the equipment. If continual lockouts occur call a mechanic immediately and have them check for: water flow problems, water temperature problems, air flow problems or air temperature problems. Use of the pressure and temperature charts for the unit may be required to properly determine the cause.

**Table 1: Dimensions**

Model	Vertical Unit (In)			Horizontal Unit (In)			Supply Air Connection (In)		Return Air Connection* (In)		Replacement Filter Nominal Size* (In)
	Width	Depth	Height	Width	Depth	Height	Width	Height	Width	Height	
EP007	21.75	21.75	32.75	21.75	43.25	16.75	11.75	7.75	H: 20.25 V: 18.0	H: 13.0 V: 13.0	H: 15"x20"x1" (1) V: 15"x20"x1" (1)
EP009	21.75	21.75	32.75	21.75	43.25	16.75	11.75	7.75	H: 20.25 V: 18.0	H: 13.0 V: 13.0	H: 15"x20"x1" (1) V: 15"x20"x1" (1)
EP012	21.75	21.75	32.75	22.25	45.25	19.75	7.75	11.75	H: 20.25 V: 18.0	H: 16.0 V: 16.0	H: 18"x20"x1" (1) V: 18"x20"x1" (1)
EP015	21.75	21.75	39.25	22.25	45.25	19.75	13.75	13.75	H: 20.25 V: 18.0	H: 16.0 V: 18.0	H: 18"x20"x1" (1) V: 20"x20"x1" (1)
EP018	21.75	21.75	39.25	22.25	45.25	19.75	13.75	13.75	H: 20.25 V: 18.0	H: 16.0 V: 18.0	H: 18"x20"x1" (1) V: 20"x20"x1" (1)
EP024	21.75	26.25	47.25	26.25	54.75	22.00	13.75	15.75	H: 30.25 V: 22.0	H: 18.0 V: 22.0	H: 20"x30"x1" (1) V: 24"x24"x1" (1)
EP030	24.25	33.50	47.25	30.25	68.25	22.00	15.75	15.75	H: 35.0 V: 28.0	H: 18.0 V: 22.0	H: 20"x34.5"x1" (1) V: 24"x30"x1" (1)
EP036	24.25	33.50	47.25	30.25	68.25	22.00	15.75	15.75	H: 35.0 V: 28.0	H: 18.0 V: 22.0	H: 20"x34.5"x1" (1) V: 24"x30"x1" (1)
EP042	26.25	33.50	58.25	30.25	79.00	22.00	17.75	17.75	H: 48.25 V: 28.0	H: 18.0 V: 30.0	H: 24"x20"x1" (2) V: 16"x30"x1" (2)
EP048	26.25	33.50	58.25	30.25	79.00	22.00	17.75	17.75	H: 48.25 V: 28.0	H: 18.0 V: 30.0	H: 24"x20"x1" (2) V: 16"x30"x1" (2)
EP060	26.25	33.50	66.25	30.25	89.25	22.00	17.75	17.75	H: 56.25 V: 28.0	H: 18.0 V: 38.0	H: 28"x20"x1" (2) V: 20"x30"x1" (2)
EP070	26.00	33.50	66.50	30.00	89.00	22.00	17.75	17.75	H: 56.25 V: 28.0	H: 18.0 V: 38.0	H: 28"x20"x1" (2) V: 20"x30"x1" (2)

\*H = Horizontal Unit; V = Vertical Unit

Table 2: Physical Data

Model	Front Clearance (in.)	Water Coil Volume (gals.)	Installation Weight (Vertical / Horizontal) (lbs.)	Shipping Weight (Vertical / Horizontal) (lbs.)
EP007	36	0.15	140 / 165	160 / 185
EP009	36	0.15	154 / 172	174 / 192
EP012	36	0.31	166 / 173	186 / 205
EP015	36	0.31	191 / 190	208 / 218
EP018	36	0.31	195 / 198	212 / 222
EP024	36	0.48	229 / 307	242 / 340
EP030	36	0.39	269 / 358	292 / 404
EP036	36	0.62	281 / 369	304 / 415
EP042	36	0.62	334 / 400	360 / 465
EP048	36	0.62	340 / 405	366 / 470
EP060	36	0.62	396 / 452	422 / 520
EP070	36	0.85	444 / 494	470 / 562

<b>Table 3: Air Temperature Rise/Fall</b>				
Entering Fluid Temp °F	<b>COOLING</b>		<b>HEATING</b>	
	Entering Air Temp °F	Air Temp Drop °F	Entering Air Temp °F	Air Temp Rise °F
30			60	16-8 - 25.1
			70	15.9 - 23.7
			80	14.8 - 22.1
40	75/63	21.9 - 27.2	60	20.0 - 28.5
	80/67	22.9 - 28.5	70	19.0 - 27.0
	85/71	23.8 - 29.5	80	17.7 - 25.2
50	75/63	20.5 - 25.8	60	23.3 - 32.8
	80/67	21.5 - 27	70	22.0 - 31.0
	85/71	22.3 - 28.1	80	20.5 - 29.0
60	75/63	19.2 - 24.7	60	26.5 - 37.1
	80/67	20.1 - 25.8	70	25.1 - 35.1
	85/71	20.9 - 26.8	80	23.4 - 32.7
70	75/63	17.9 - 23.8	60	29.8 - 41.4
	80/67	18.7 - 24.9	70	28.2 - 39.1
	85/71	19.5 - 25.8	80	26.3 - 36.4
80	75/63	16.6 - 23.0	60	32.7 - 45.7
	80/67	17.4 - 24.0	70	30.9 - 43.1
	85/71	18.1 - 25.0	80	28.8 - 40.2
85	75/63	16.0 - 22.6		
	80/67	16.8 - 23.6		
	85/71	17.4 - 24.5		
90	75/63	15.4 - 22.2		
	80/67	16.1 - 23.2		
	85/71	16.8 - 24.1		
100	75/63	14.2 - 21.4		
	80/67	14.9 - 22.4		
	85/71	15.4 - 23.3		
110	75/63	13.0 - 21.1		
	80/67	13.7 - 22.1		
	85/71	14.2 - 23.0		



**Table 4: Refrigerant Pressure Ranges**

Entering Fluid Temp °F	Fluid Δ T	COOLING						HEATING			
		Entering Air Temp (Dry Bulb)						Entering Air Temp (Dry Bulb)			
		70 °F		75 °F		80 °F		60 °F		70 °F	
		Suction	Discharge	Suction	Discharge	Suction	Discharge	Suction	Discharge	Suction	Discharge
30	5							68 - 79	233 - 266	71 - 84	246 - 281
	10							65 - 76	222 - 255	68 - 80	235 - 269
	15							59 - 71	216 - 248	62 - 75	228 - 261
40	5	113 - 147	138 - 156	117 - 152	142 - 161	119 - 155	145 - 164	80 - 95	244 - 282	85 - 100	257 - 297
	10	113 - 147	145 - 164	117 - 152	150 - 170	119 - 155	153 - 173	77 - 91	237 - 274	82 - 96	250 - 289
	15	113 - 147	151 - 170	117 - 152	156 - 175	119 - 155	159 - 179	72 - 86	226 - 262	76 - 90	238 - 276
50	5	115 - 149	164 - 185	119 - 154	170 - 191	121 - 157	173 - 195	95 - 113	255 - 302	100 - 119	269 - 319
	10	115 - 149	173 - 194	119 - 154	178 - 200	121 - 157	182 - 204	91 - 109	248 - 290	96 - 115	261 - 306
	15	115 - 149	179 - 200	119 - 154	184 - 207	121 - 157	188 - 211	86 - 103	237 - 282	90 - 108	250 - 297
60	5	117 - 151	194 - 218	121 - 156	200 - 224	123 - 159	204 - 229	111 - 133	270 - 324	117 - 141	285 - 342
	10	117 - 151	204 - 228	121 - 156	211 - 235	123 - 159	215 - 240	106 - 129	258 - 311	112 - 136	273 - 329
	15	117 - 151	211 - 235	121 - 156	218 - 242	123 - 159	222 - 247	101 - 122	251 - 302	106 - 128	265 - 319
70	5	119 - 153	228 - 254	122 - 158	235 - 262	125 - 161	240 - 267	129 - 158	282 - 343	136 - 167	297 - 362
	10	119 - 153	238 - 265	122 - 158	246 - 273	125 - 161	251 - 279	124 - 150	274 - 333	131 - 159	289 - 351
	15	119 - 153	246 - 273	122 - 158	254 - 281	125 - 161	259 - 287	117 - 146	262 - 320	123 - 154	276 - 337
80	5	121 - 155	265 - 294	124 - 160	273 - 303	127 - 163	279 - 309	148 - 184	299 - 366	156 - 194	315 - 387
	10	121 - 155	276 - 306	124 - 160	285 - 316	127 - 163	291 - 322	143 - 176	286 - 352	151 - 185	302 - 371
	15	121 - 155	285 - 315	124 - 160	294 - 325	127 - 163	300 - 332	136 - 169	278 - 343	143 - 179	294 - 362
90	5	123 - 157	306 - 337	126 - 162	316 - 348	129 - 165	322 - 355				
	10	123 - 157	319 - 351	126 - 162	329 - 363	129 - 165	336 - 370				
	15	123 - 157	329 - 362	126 - 162	339 - 373	129 - 165	346 - 381				
100	5	124 - 159	351 - 387	128 - 164	363 - 399	131 - 167	370 - 407				
	10	124 - 159	367 - 403	128 - 164	378 - 416	131 - 167	386 - 424				
	15	124 - 159	376 - 413	128 - 164	388 - 426	131 - 167	396 - 435				
110	5	126 - 161	403 - 441	130 - 166	416 - 455	133 - 169	424 - 464				
	10	126 - 161	419 - 458	130 - 166	432 - 472	133 - 169	441 - 482				
	15	126 - 161	429 - 470	130 - 166	443 - 485	133 - 169	452 - 495				

This chart shows approximate temperatures and pressures for a unit in good repair. The values shown are meant as a guide only and should not be used to estimate system charge.

This chart assumes rated air flow and 80° d.b./67° w.b. entering air temperature in cooling, 70° d.b. entering air temperature in heating. Heating data at entering fluid temperatures below 50° assumes the use of antifreeze.

As a result of continuing research and development, specifications are subject to change without notice.

**Table 5: Fluid Pressure Drops**

Model	Flow Rate (GPM)	Pressure Drop (FOH)	Pressure Drop (PSI)	Model	Flow Rate (GPM)	Pressure Drop (FOH)	Pressure Drop (PSI)
<b>007</b>	1	1.4	0.61	<b>030</b>	4	1.2	0.51
	1.5	2.9	1.26		5.5	2.1	0.91
	2	4.9	2.11		7	3.2	1.41
	3	10.1	4.38		10	6.1	2.67
	4	16.9	7.34		13	9.9	4.28
<b>009</b>	1.5	2.3	1.00	<b>036</b>	5	1.6	0.71
	2	3.9	1.68		7.5	3.3	1.45
	2.5	5.8	2.51		10	5.6	2.43
	3.25	9.3	4.03		12.5	8.4	3.64
	4	13.5	5.85		15	11.8	5.11
<b>012</b>	2	1.7	0.72	<b>042</b>	7	3.0	1.30
	3	3.4	1.50		8.75	4.4	1.91
	4	5.8	2.51		10.5	6.1	2.66
	5.5	10.2	4.45		13.25	9.3	4.04
	7	15.8	6.88		16	13.2	5.74
<b>015</b>	2	1.6	0.69	<b>048</b>	8	3.8	1.65
	3	3.3	1.44		10.67	6.3	2.73
	4	5.5	2.41		12	7.8	3.38
	5.5	9.8	4.28		14	10.3	4.46
	7	15.2	6.60		16	13.2	5.75
<b>018</b>	3	4.1	1.80	<b>060</b>	9	4.7	2.04
	4	7.0	3.02		12	7.8	3.38
	5	10.4	4.52		15	11.7	5.05
	6.5	16.7	7.25		17.5	15.4	6.66
	8	24.2	10.53		20	19.8	8.58
<b>024</b>	3	2.0	0.87	<b>070</b>	10	2.8	1.24
	4.5	4.1	1.80		13.5	4.9	2.12
	6	6.9	3.01		17	7.4	3.22
	8	11.6	5.06		20.5	10.4	4.50
	10	17.4	7.56		24	13.8	5.98

**Table 6: Standard Motor - PSC for 007-012, Constant Torque for 015-070**

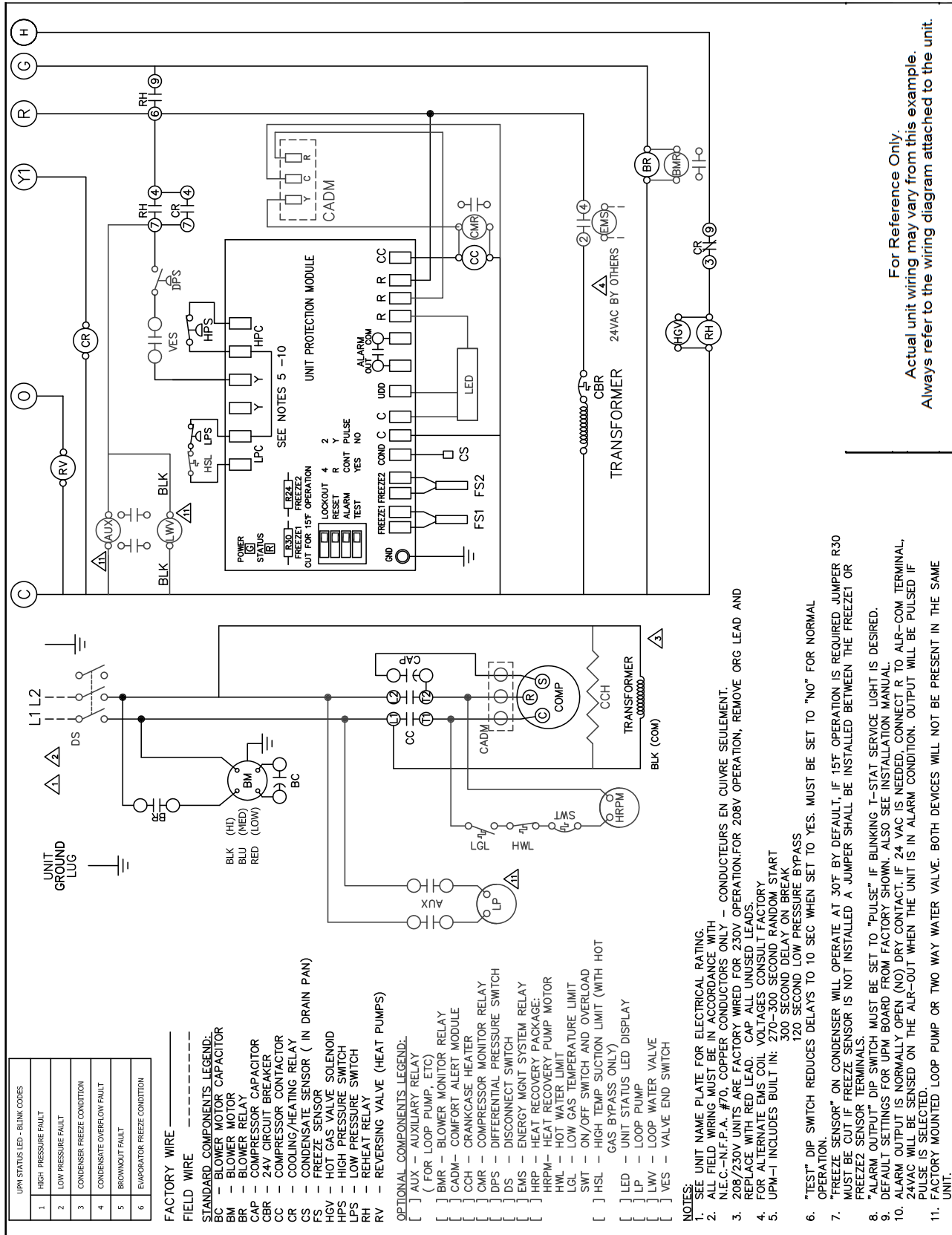
Model	Available External Static Pressure (inches of Water)												
	Motor Speed	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2
EP007	High	430	420	390	360	335	310	260	-	-	-	-	-
	Medium	420	390	365	335	310	270	-	-	-	-	-	-
	Low	370	360	340	315	285	245	-	-	-	-	-	-
EP009	High	430	420	390	360	335	310	260	-	-	-	-	-
	Medium	420	390	365	335	310	270	-	-	-	-	-	-
	Low	370	360	340	315	285	245	-	-	-	-	-	-
EP012	High	450	435	415	400	385	360	330	305	-	-	-	-
	Medium	425	405	385	375	360	335	310	-	-	-	-	-
	Low	390	380	365	350	335	315	290	-	-	-	-	-
EP015	High	710	685	650	610	575	545	460	370	-	-	-	-
	Medium	530	510	480	445	405	360	-	-	-	-	-	-
	Low	430	410	370	335	290	245	-	-	-	-	-	-
EP018	High	730	700	660	615	580	545	505	460	-	-	-	-
	Medium	615	575	540	500	460	420	-	-	-	-	-	-
	Low	540	510	480	445	405	360	-	-	-	-	-	-
EP024	High	975	945	910	880	855	825	790	750	-	-	-	-
	Medium	905	885	855	825	790	755	700	650	-	-	-	-
	Low	725	700	670	640	585	530	-	-	-	-	-	-
EP030	High	1225	1195	1170	1140	1110	1075	1010	940	745	-	-	-
	Medium	1110	1075	1045	1015	985	955	915	880	700	-	-	-
	Low	955	925	890	860	825	790	750	715	685	-	-	-
EP036	High	1440	1420	1400	1380	1345	1315	1240	1165	1005	845	-	-
	Medium	1340	1315	1290	1270	1245	1225	1180	1135	990	845	-	-
	Low	1190	1165	1140	1115	1090	1065	1040	1020	915	810	-	-
EP042	High	1645	1635	1610	1585	1560	1535	1510	1485	1460	1430	-	-
	Medium	1455	1425	1400	1375	1345	1320	1290	1260	1225	1190	-	-
	Low	1220	1190	1160	1130	1100	1070	1015	955	895	830	-	-
EP048	High	1840	1820	1795	1775	1745	1720	1695	1670	1645	1615	-	-
	Medium	1655	1635	1610	1585	1560	1535	1510	1485	1460	1430	-	-
	Low	1455	1425	1400	1375	1345	1320	1290	1260	1225	1190	-	-
EP060	High	2225	2195	2165	2135	2105	2075	2045	2015	1980	1945	1900	1850
	Medium	2070	2045	2015	1990	1960	1925	1895	1870	1840	1810	1685	1600
	Low	1815	1785	1755	1725	1695	1665	1630	1595	1555	1515	1425	-
EP070	High	2560	2520	2480	2440	2400	2360	2320	2275	2245	2210	2150	2050
	Medium	2440	2400	2360	2320	2280	2245	2200	2155	2120	2085	2000	1900
	Low	1920	1880	1835	1795	1745	1695	1655	1615	1570	1520	1425	-

**Table 7: Constant CFM Motor**

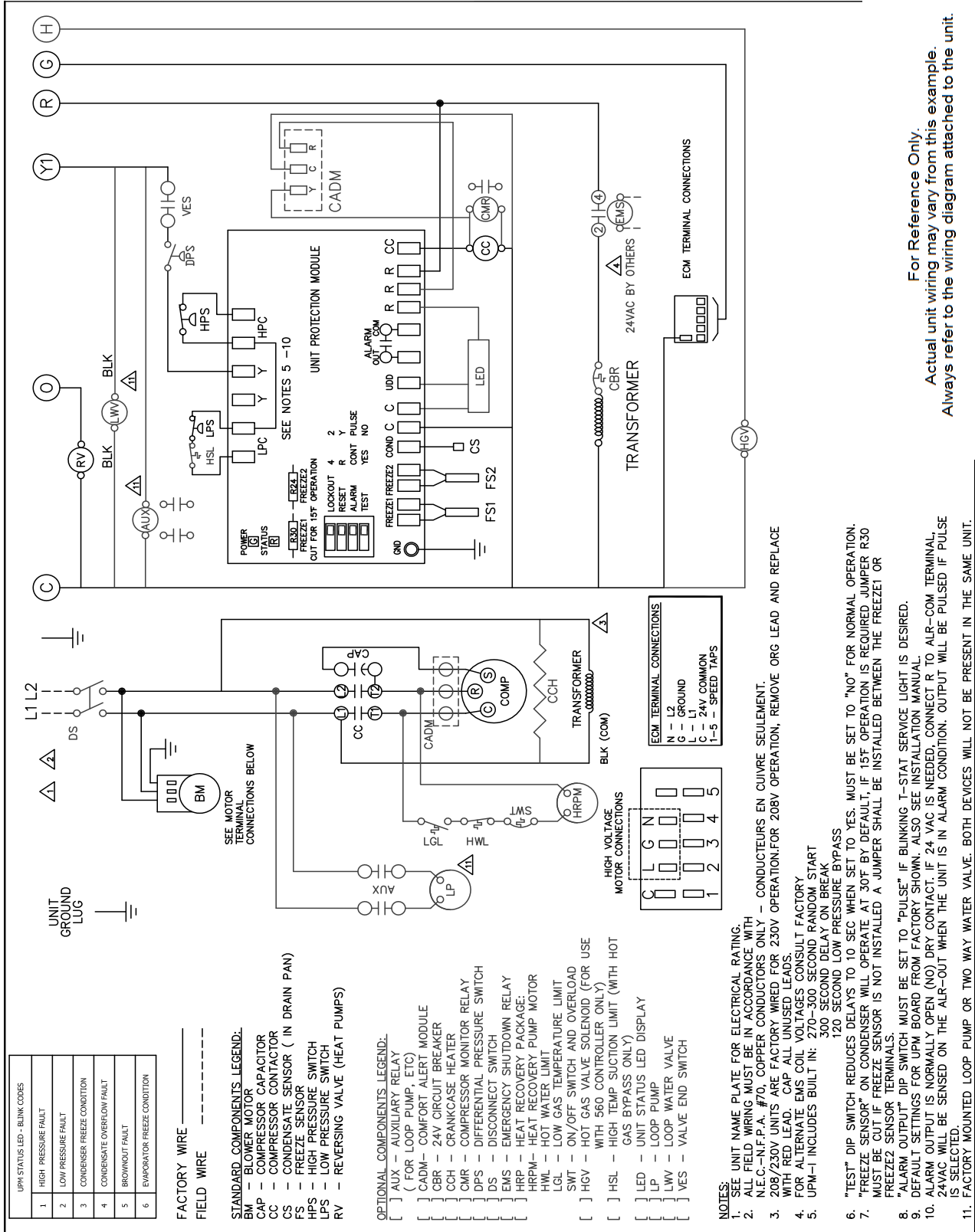
Model	Available External Static Pressure (inches of Water)												
	Motor Speed	0.1	0.2	0.3	0.4	0.5	0.6	0.7	0.8	0.9	1	1.1	1.2
EP015	+	575	575	575	575	575	575	575	575	-	-	-	-
	Normal	500	500	500	500	500	500	500	500	-	-	-	-
	-	425	425	425	425	425	425	425	425	-	-	-	-
EP018	+	745	745	745	745	745	745	745	745	-	-	-	-
	Normal	650	650	650	650	650	650	650	650	-	-	-	-
	-	555	555	555	555	555	555	555	555	-	-	-	-
EP024	+	1095	1095	1095	1095	1095	1095	1095	1095	1095	-	-	-
	Normal	950	950	950	950	950	950	950	950	950	-	-	-
	-	810	810	810	810	810	810	810	810	810	-	-	-
EP030	+	1150	1150	1150	1150	1150	1150	1150	1150	1150	-	-	-
	Normal	1000	1000	1000	1000	1000	1000	1000	1000	1000	-	-	-
	-	850	850	850	850	850	850	850	850	850	-	-	-
EP036	+	1380	1380	1380	1380	1380	1380	1380	1380	1380	1380	-	-
	Normal	1200	1200	1200	1200	1200	1200	1200	1200	1200	1200	-	-
	-	1020	1020	1020	1020	1020	1020	1020	1020	1020	1020	-	-
EP042	+	1610	1610	1610	1610	1610	1610	1610	1610	1610	1610	-	-
	Normal	1400	1400	1400	1400	1400	1400	1400	1400	1400	1400	-	-
	-	1190	1190	1190	1190	1190	1190	1190	1190	1190	1190	-	-
EP048	+	1840	1840	1840	1840	1840	1840	1840	1840	1840	1840	-	-
	Normal	1600	1600	1600	1600	1600	1600	1600	1600	1600	1600	-	-
	-	1360	1360	1360	1360	1360	1360	1360	1360	1360	1360	-	-
EP060	+	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300	2300
	Normal	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
	-	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	1700	-
EP070	+	2415	2415	2415	2415	2415	2415	2415	2415	2415	2415	2415	2415
	Normal	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100	2100
	-	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	1785	-

# TYPICAL WIRING DIAGRAMS

## PSC Motor | Hot Gas Reheat | Single Phase | Single Stage

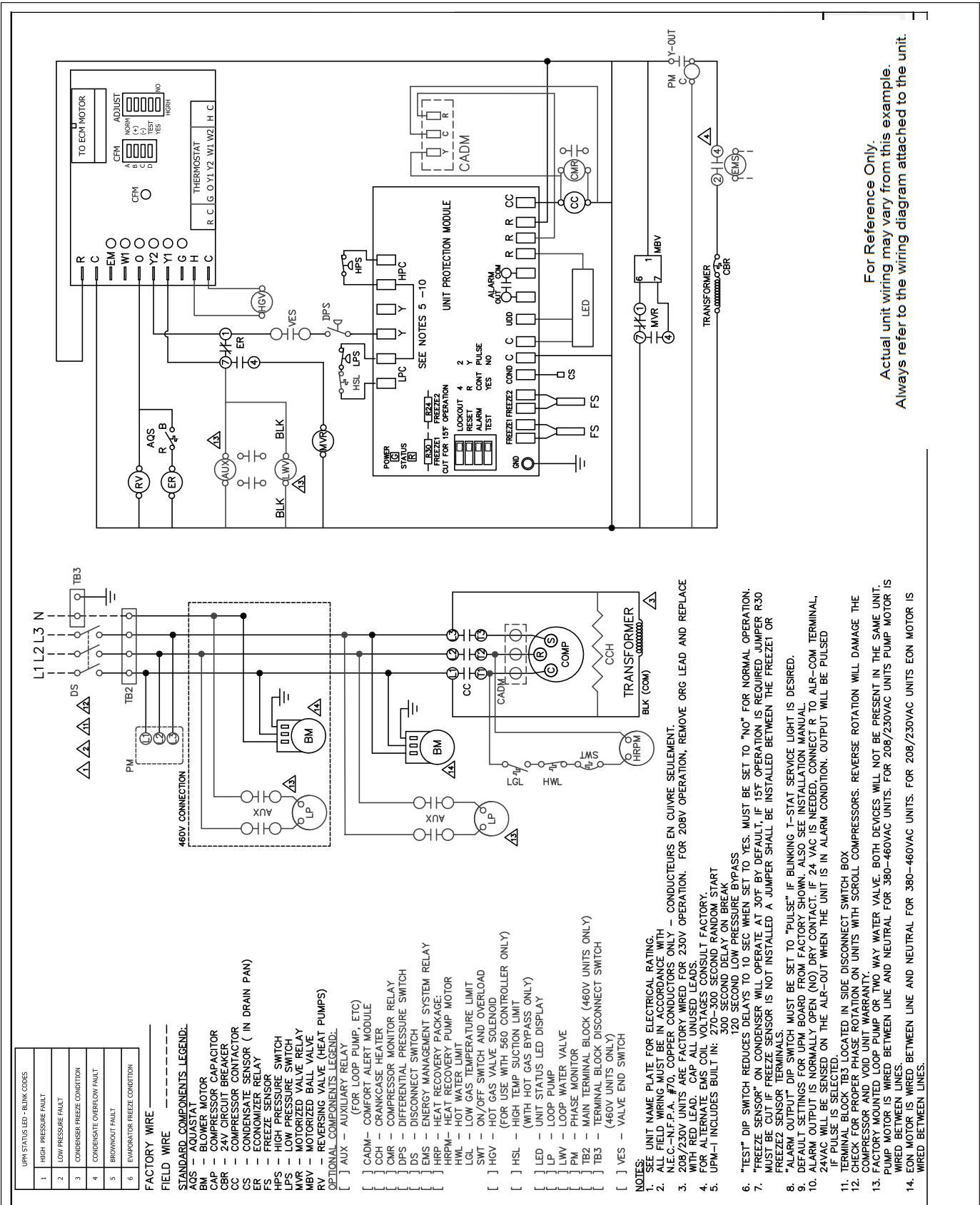


X13 Motor | Single Phase | Single Stage



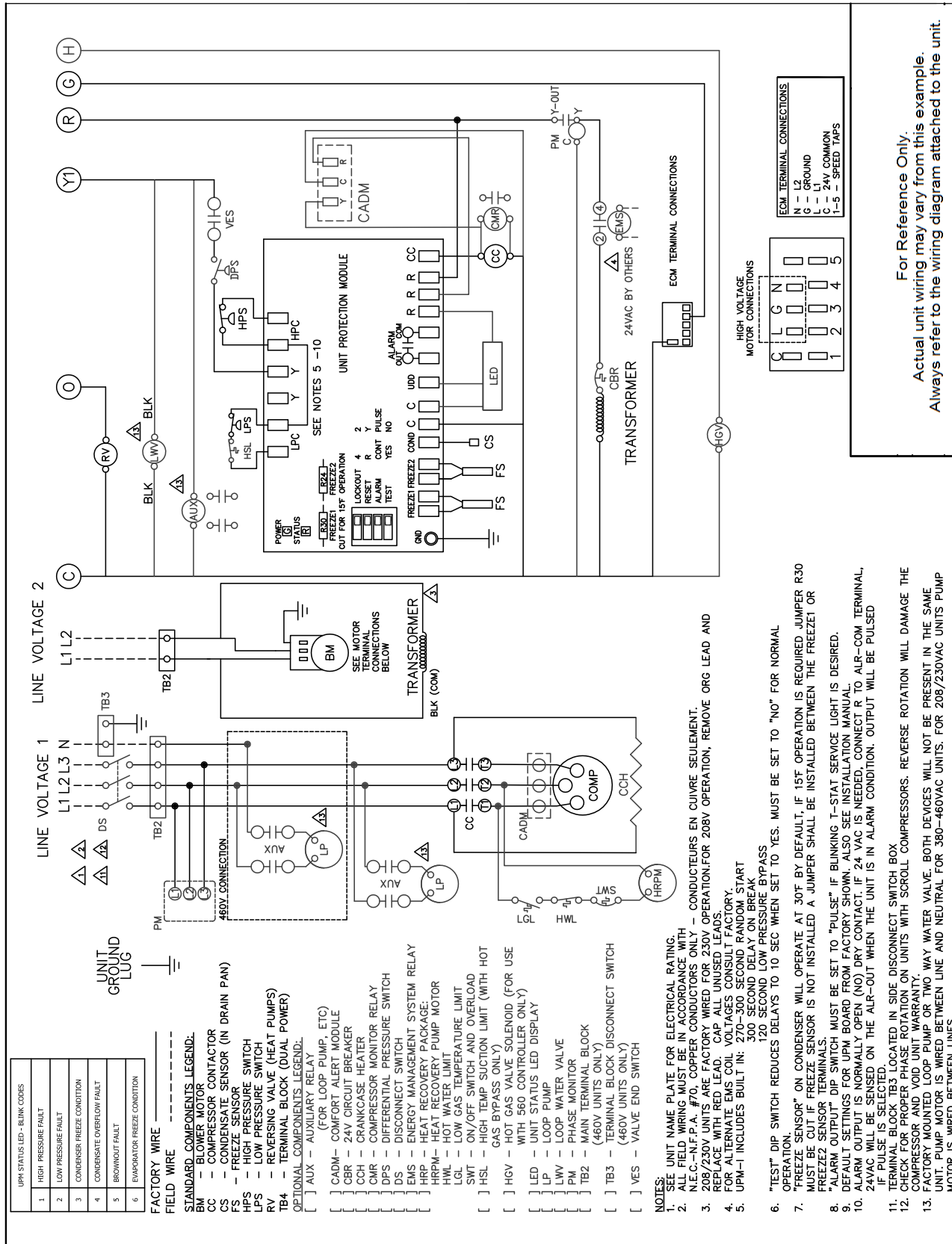
For Reference Only.  
 Actual unit wiring may vary from this example.  
 Always refer to the wiring diagram attached to the unit.

EON Motor | Economizer | Three Phase | Single Stage



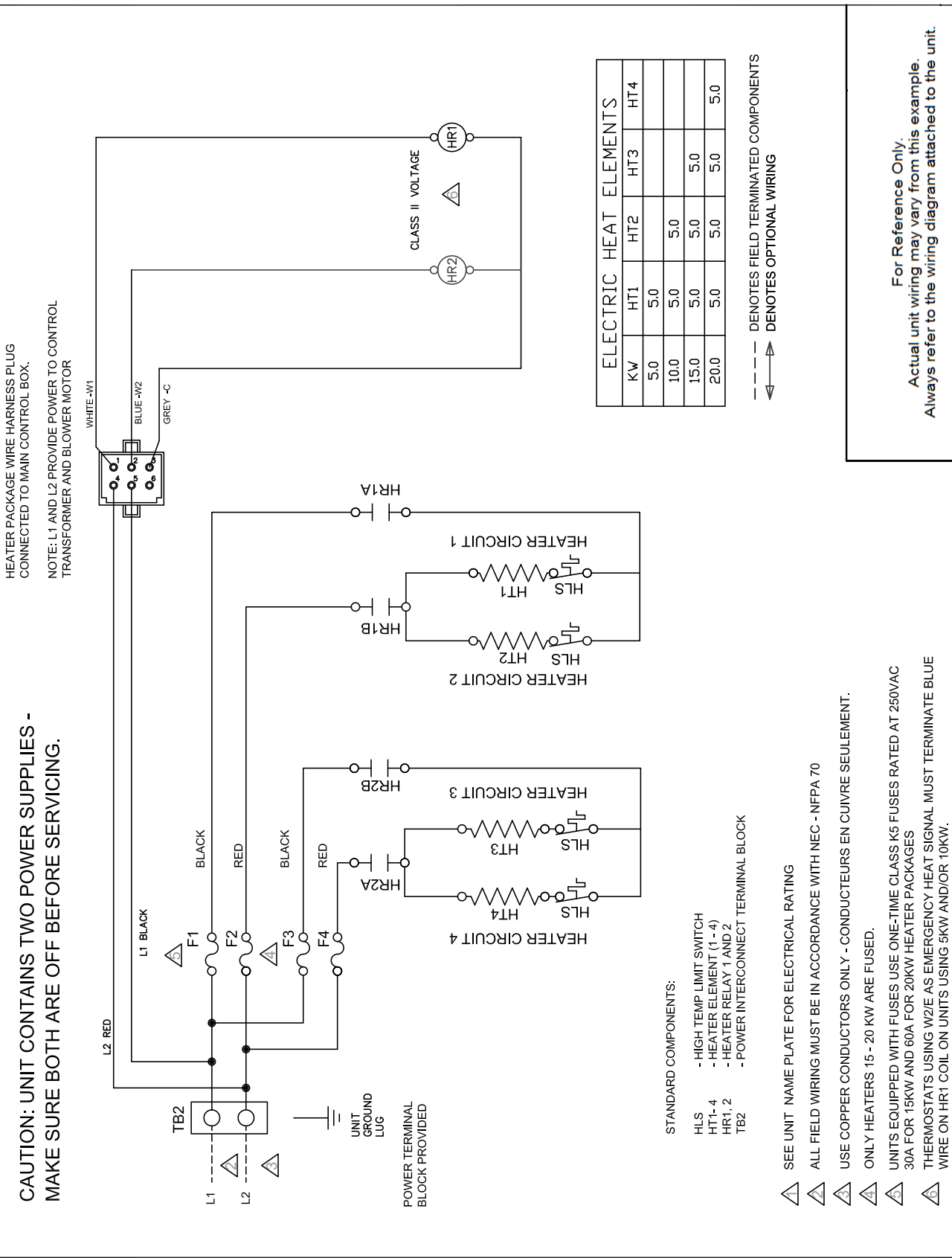
For Reference Only.  
 Actual unit wiring may vary from this example.  
 Always refer to the wiring diagram attached to the unit.

X13 Motor | Dual Power Supply | Three Phase | Single Stage





# Electric Heat Wiring Diagram

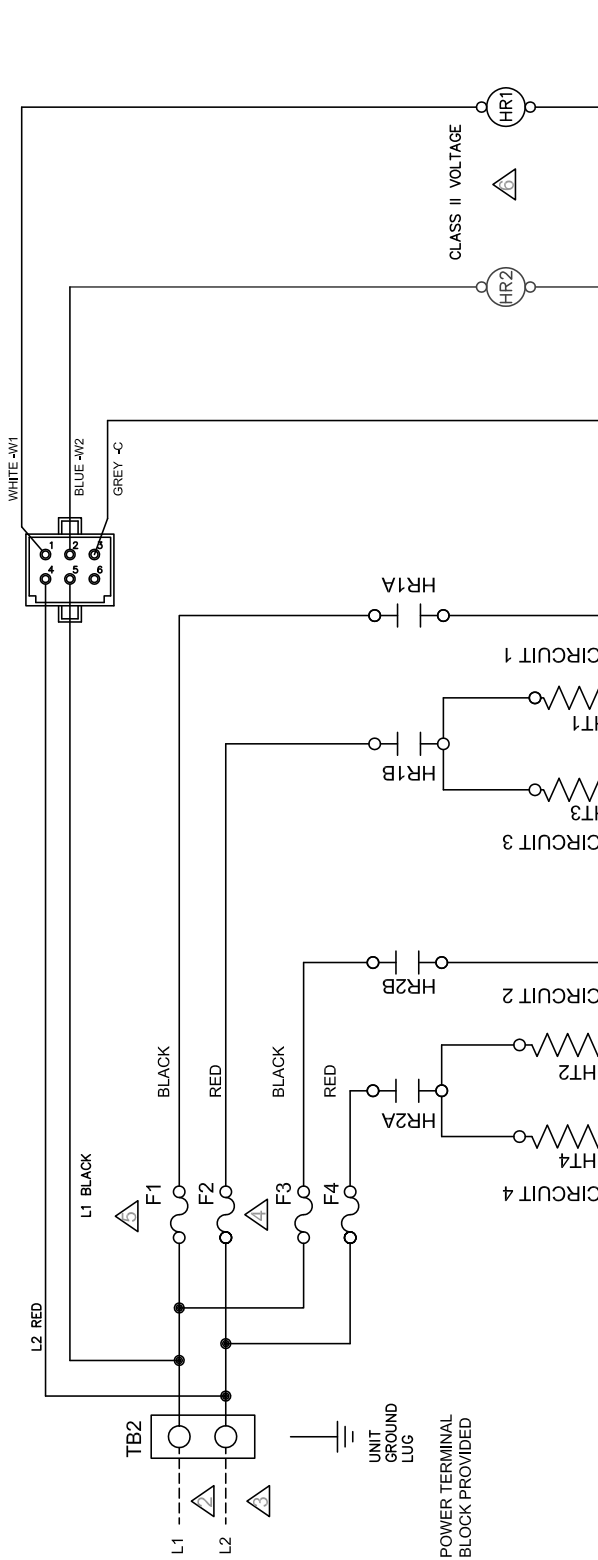


Electric Heat Wiring Diagram

HEATER PACKAGE WIRE HARNESS PLUG CONNECTED TO MAIN CONTROL BOX.

NOTE: L1 AND L2 PROVIDE POWER TO CONTROL TRANSFORMER AND BLOWER MOTOR

CAUTION: UNIT CONTAINS TWO POWER SUPPLIES - MAKE SURE BOTH ARE OFF BEFORE SERVICING.



POWER TERMINAL BLOCK PROVIDED

ELECTRIC HEAT ELEMENTS				
KW	HT1	HT2	HT3	HT4
5.0	5.0			
10.0	5.0	5.0		
15.0	5.0	5.0	5.0	
20.0	5.0	5.0	5.0	5.0

STANDARD COMPONENTS:

- HLS - HIGH TEMP LIMIT SWITCH
- HT1-4 - HEATER ELEMENT (1-4)
- HR1, 2 - HEATER RELAY 1 AND 2
- TB2 - POWER INTERCONNECT TERMINAL BLOCK

--- DENOTES FIELD TERMINATED COMPONENTS  
 ---> DENOTES OPTIONAL WIRING

- ▲ SEE UNIT NAME PLATE FOR ELECTRICAL RATING
- ▲ ALL FIELD WIRING MUST BE IN ACCORDANCE WITH NEC - NFPA 70
- ▲ USE COPPER CONDUCTORS ONLY - CONDUCTEURS EN CUIVRE SEULEMENT.
- ▲ ONLY HEATERS 15 - 20 KW ARE FUSED.
- ▲ UNITS EQUIPPED WITH FUSES USE ONE-TIME CLASS K5 FUSES RATED AT 250VAC 30A FOR 15KW AND 60A FOR 20KW HEATER PACKAGES
- ▲ THERMOSTATS USING W2/E AS EMERGENCY HEAT SIGNAL MUST TERMINATE BLUE WIRE ON HR1 COIL ON UNITS USING 5KW AND/OR 10KW.

For Reference Only.  
 Actual unit wiring may vary from this example.  
 Always refer to the wiring diagram attached to the unit.

## UNIT CHECK-OUT SHEET

### Customer Data

Customer Name \_\_\_\_\_ Date \_\_\_\_\_  
 Address \_\_\_\_\_  
 Phone \_\_\_\_\_ Unit Number \_\_\_\_\_

### Unit Nameplate Data

Unit Make \_\_\_\_\_  
 Model Number \_\_\_\_\_ Serial Number \_\_\_\_\_  
 Refrigerant Charge (oz) \_\_\_\_\_  
 Compressor: RLA \_\_\_\_\_ LRA \_\_\_\_\_  
 Blower Motor: FLA (or NPA) \_\_\_\_\_ HP \_\_\_\_\_  
 Maximum Fuse Size (Amps) \_\_\_\_\_  
 Minimum Circuit Ampacity (Amps) \_\_\_\_\_

### Operating Conditions

	Cooling Mode	Heating Mode
Entering / Leaving Air Temp	_____ / _____	_____ / _____
Entering Air Measured at:	_____	_____
Leaving Air Measured at:	_____	_____
Entering / Leaving Fluid Temp	_____ / _____	_____ / _____
Fluid Flow (gpm)	_____	_____
Compressor Volts / Amps	_____ / _____	_____ / _____
Blower Motor Volts / Amps	_____ / _____	_____ / _____
Source Fluid Type	_____	_____
Fluid Flow (gpm)*	_____	_____
Fluid Side Pressure Drop*	_____	_____
Suction / Discharge Pressure (psig)*	_____ / _____	_____ / _____
Suction / Discharge Temp*	_____ / _____	_____ / _____
Suction Superheat*	_____	_____
Entering TXV / Cap Tube Temp*	_____	_____
Liquid Subcooling*	_____	_____

\* Required for Troubleshooting ONLY

### Auxiliary Heat

Unit Make \_\_\_\_\_  
 Model Number \_\_\_\_\_ Serial Number \_\_\_\_\_  
 Max Fuse Size (Amps) \_\_\_\_\_  
 Volts / Amps \_\_\_\_\_ / \_\_\_\_\_  
 Entering Air Temperature \_\_\_\_\_  
 Leaving Air Temperature \_\_\_\_\_

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**TROUBLESHOOTING**

Problem	Possible Cause	Checks and Corrections
Entire unit does not run	Power Supply Off	Apply power, close disconnect
	Blown Fuse	Replace fuse or reset circuit breaker. Check for correct fuses
	Voltage Supply Low	If voltage is below minimum voltage specified on unit data plate, contact local power company.
	Thermostat	Set the fan to "ON", the fan should run. Set thermostat to "COOL" and lowest temperature setting, the unit should run in the cooling mode (reversing valve energized). Set unit to "HEAT" and the highest temperature setting, the unit should run in the heating mode (reversing valve deenergized). If neither the blower or compressor run in all three cases, the thermostat could be miswired or faulty. To ensure miswired or faulty thermostat verify that 24 volts is available at the low voltage terminal strip between "R" and "C", "Y" and "C", and "O" and "C". If the blower does not operate, verify 24 volts between terminals "G" and "C". Replace the thermostat if defective.
Blower operates but compressor does not	Thermostat	Check setting, calibration, and wiring
	Wiring	Check for loose or broken wires at compressor, capacitor, or contactor
	Safety Controls	Check UPM board red default L.E.D. for Blink Code
	Compressor overload open	If the compressor is cool and the overload will not reset, replace compressor
	Compressor motor grounded	Internal winding grounded to the compressor shell. Replace compressor.
	Compressor windings Open	After compressor has cooled, check continuity of the compressor windings. If the windings are open, replace the compressor
Unit off on high pressure control	Discharge pressure too high	In "COOLING" mode: Lack of or inadequate water flow. Entering water temperature is too warm. Scaled or plugged condenser. In "HEATING" mode: Lack of or inadequate air flow. Blower inoperative, clogged filter or restrictions in duct work
	Refrigerant charge	The unit is overcharged with refrigerant. Reclaim refrigerant, evacuate and recharge with factor recommended charge.
	High pressure	Check for defective or improperly calibrated high pressure switch.
Unit off on low pressure control	Suction pressure too low	In "COOLING" mode: Lack of or inadequate air flow. Entering air temperature is too cold. Blower inoperative, clogged filter or restrictions in duct work In "HEATING" mode: Lack of or inadequate water flow. Entering water temperature is too cold. Scaled or plugged condenser.
	Refrigerant charge	The unit is low on refrigerant. Check for refrigerant leak, repair, evacuate and recharge with factory recommended charge.
	Low pressure switch	Check for defective or improperly calibrated low pressure switch.
Unit short cycles	Unit oversized	Recalculate heating and or cooling loads.
	Thermostat	Thermostat installed near a supply air grill; relocate thermostat. Readjust heat anticipator.
	Wiring and controls	Check for defective or improperly calibrated low pressure switch.

Insufficient cooling or heating	Unit undersized	Recalculate heating and or cooling loads. If excessive, possibly adding insulation and shading will rectify the problem
	Loss of conditioned air by leakage	Check for leaks in duct work or introduction of ambient air through doors or windows
	Airflow	Lack of adequate air flow or improper distribution of air. Replace dirty filter
	Refrigerant charge	Low on refrigerant charge causing inefficient operation
	Compressor	Check for defective compressor. If discharge is too low and suction pressure is too high, compressor is not pumping properly. Replace compressor.
	Reversing Valve	Defective reversing valve creating bypass of refrigerant from discharge of suction side of compressor. Replace reversing valve
	Operating pressures	Compare unit operation pressures to the pressure/temperature chart for the unit.
	TXV	Check TXV for possible restriction or defect. Replace if necessary.
	Moisture, noncondensables	The refrigerant system may be contaminated with moisture or noncondensables. Reclaim refrigerant, replace filter dryer, evacuate the refrigerant system, and recharge with factory recommended charge.
UPM board trouble shooting	Compressor will not run, no fault blink code	<pre> graph TD     Q1[Is Green Power LED light on and no Red Blink Code?] -- No --&gt; A1["- Check all power supplies - Check all safety switches"]     Q1 -- Yes --&gt; Q2[Is there power to the "Y" Call (C-Y)?]     Q2 -- No --&gt; A2[Check thermostat settings and configurations for heat pumps, and wiring]     Q2 -- Yes --&gt; Q3[Is there 24 V power from C to CC?]     Q3 -- No --&gt; A3[Check for Red Blink Code. If Red Blink Code is not present, replace UPM Board]     Q3 -- Yes --&gt; A4[UPM Board is Good]     </pre>







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